A.4.1

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

August 23, 1990

Nadine Romero

TO: Ronda Hall, Permits

FROM: Nadine L. Romero, Geotech Unit

SUBJECT: Detrex Corporation-Gold Shield Solvents
Closure Plan Revision
MID 020 906 764

I have reviewed the revised Detrex closure plan submitted July 24, 1990. The Detrex facility should proceed with implementing their soil and ground water assessment/closure work plan with the following stipulations:

1. As discussed in the June, 1990 meeting and in my previous review comments of April 10, 1990, Detrex can use well screens of up to 5 feet in length only. No justification was provided in this work plan in support of screen lenths greater than 5 feet. If the full saturated thickness of the aquifer is 10 feet then 2 wells screening the upper five feet and lower 5 feet of the saturated unit will have to be installed. If the saturated thickness is less than 10 feet, I would proceed with only a 5 foot well screen placed in the aquifer based on the specific gravity of the TCE, DCE etc. (if the TCE and volatiles were in an oil carrier, than I would screen the top 5 feet of the aquifer).

2. It was still not clear from this work plan where the third ground water monitoring well will be installed. This third well should be based on information derived from previously drilled wells. ground water flow direction and knowledge of contamination transport and source areas.

It is up to the facility to do the most comprehensive investigation feasible in this phase, ascertaining the rate and extent of soil and ground water contamination. The results of this phase will be closely reviewed by this office, the use of well screens greater than 5 feet will be viewed as unacceptable and well placement should be as "strategic" as possible. Please see me if you have any additional comments or concerns.

cc: De Montgomery/Geotech Unit
Marilyn Sabadaszka, EPA Region V Reporting
HWP C&E File

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

April 10, 1990

TO: Ronda Hall, Permits

FROM: Nadine Romero, Geotech Unit Nadine L Romero

SUBJECT: Detrex Corporation-Gold Shield Solvents
Closure Plan Revision
MID 020 906 764

I have reviewed the revised Detrex closure plan submitted February 13, 1990. In addition, I have also reviewed the hydrogeological portion of the Detrex Act 64 application, to get a better handle on which aquifer hydraulic properties have been defined.

The facility has identified contamination in the fill and the sand and gravel unit and it is imperative a thorough groundwater assessment study be completed. Surprisingly, the Act 64 hydrogeological report did not determine groundwater flow direction, hydraulic conductivity and groundwater flow velocity for the fill and the "upper" aquifer. Furthermore, no groundwater analytical data was provided. Therefore, the next phase of this closure investigation must identify groundwater flow directions, vertical and horizontal groundwater flow rates, the extent of the clay units between aquifers, any aquifer hydraulic interconnections and analysis of groundwaters for existing and proposed wells.

It is recommended split spoons be taken at 0, 2 and 5 feet for analysis and every 5 feet thereafter, to the top of the water table. Additional groundwater monitoring wells should be placed at key "HOT SPOT" areas. This includes the area immediate to Borings BH2 and BH4. Well screens may not be longer than 5 feet, which may require a well cluster to screen the full saturated thickness of the upper aquifer.

Based on the results of this next phase of investigation, aquifer hydaulic data, soil results and a set of groundwater analysis for all wells, a phase III workplan will need to be submitted.

This concludes my review of the revised closure plan for Detrex. Please see me if there are any questions or concerns.

cc: De Montgomery
Geotech File
C&E File

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

December 28, 1989

TO: Ronda Hall, Permits Unit, Waste Management Division

FROM: Nadine Romero, Geotech Unit, Waste Management Division Nadine

SUBJECT: Closure Plan Review Comments on Detrex - Gold Shield Solvents MID 020 906 764

I have reviewed the June 5, 1989 closure plan submittal from the Detrex tank and container storage area which includes the site work plan and a final summary report. In addition, I have reviewed the contour concentration maps and the deficiency comments you provided.

The June 5, 1989 closure plan and data submittal does not accomplish the objective of identifying the extent of soil and/or groundwater contamination for clean closure or post-closure purposes. No specific criteria was provided in the work plan, as to how the 11 boring locations were chosen and how such locations would verify no potential impacts from the waste management units occurred.

On page 12 of the closure plan, it was stated, "further soil sampling is not required." However, based on the "limited" data provided, this assertion is not supported. In accordance with the "How Clean is Clean" procedures, a sampling grid will need to be established to define the extent of soil contamination below the hazardous waste management units.

Because soils contamination was found, verification must be given that groundwater has not been impacted. Therefore, the facility must propose a hydrogeologic work plan that may wish to utilize the previous hydrogeologic work study for the Act 64 application. The thickness of the clay unit below the fill should also be provided.

Based on the limited data supplied in the "final report," it appears two hot spots of contamination exist, one at boring location B1 and another at boring location BH11. However, as you noted previously, analytical detection limits were highly erratic, ranging from 1 to 250 parts per million. Therefore, it is not known whether contamination exists in many of the samples. Detection limits should be no more than 1 part per million for soil samples. As for some minor technical points, it was noted on some of the boring logs that the term "clay mineralization" was used and it is not clear what this term is supposed to mean. An explanation should be provided.

In summary, there is an extensive amount of work that will need to be done for closure, i.e. post-closure certification. Detrex will certainly need to start thinking about remediation measures in the interim. I reviewed your deficiency comments as well and contend with each of them. If you have any questions, please feel free to contact me.

cc: De Montgomery/Geotech Unit
C&E File
Ms. Marilyn Sabadaszka, U.S. EPA

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive,
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

June 1, 1989

Reference No.2471

Ms. Ronda L. Hall
Environmental Engineer
Waste Management Division
Hazardous Waste Permits Section
Michigan Department of Natural Resources
P.O. Box 30028
Ottawa Street Building-South Tower
Lansing, Michigan
U.S.A. 48909

Dear Ms. Hall:

Re: Detrex Corporation
Gold Shield Solvents
Grand Rapids, Michigan MID 020 906 764
Closure Plan

On behalf of Detrex Corporation, please find enclosed six (6) copies of the revised closure plan for the inactive hazardous waste units at the Gold Shield Solvents, Grand Rapids facility.

Should you have any questions, do not hesitate to contact us.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Ed Roberts, P.Eng.

RECEIVED
JUN 05 1989
Waste Management
Division

ER/cdd/2

c.c. Charles Guy (Detrex)

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive,
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

February 7, 1989

Reference No. 2471

Ms. Rhonda L. Hall
Environmental Engineer
State of Michigan
Department of Natural Resources
Hazardous Waste Permits Section
608 West Allegan
Lansing, MI
U.S.A. 48909

Dear Ms. Hall:

Re: Detrex Corporation, Gold Shield Solvents, MID020906764

Enclosed please find five (5) copies of the report entitled "Plan of Closure, Hazardous Waste Storage Tanks, Detrex Corporation, Gold Shield Solvents, Grand Rapids, Michigan" February, 1989. The referenced report is being submitted on behalf of Detrex Corporation, in response to the DNR's request in a letter addressed to Mr. C.U. Guy (Detrex), dated November 30, 1988. The letter was received by Detrex on December 12, 1988.

Should you have any question regarding the closure plan, do not hesitate to contact the undersigned.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Ed Roberts, P.Eng.

ER/jve
Encl.

c.c. C.U. Guy, (w/o encl.)

RECEIVED
FEB 07 1989
Waste Management
Division

A.4.2

PLAN OF CLOSURE

- HAZARDOUS WASTE STORAGE TANKS
- HAZARDOUS WASTE CONTAINER STORAGE AREAS

Detrex Corporation
Gold Shield Solvents
Grand Rapids, Michigan

PLAN OF CLOSURE

- **HAZARDOUS WASTE STORAGE TANKS**
- **HAZARDOUS WASTE CONTAINER STORAGE AREAS**

Detrex Corporation
Gold Shield Solvents
Grand Rapids, Michigan

June 1989
Ref. No. 2471 (7)

CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

1.1 BACKGROUND

The State of Michigan, Department of Natural Resources (MDNR), Waste Management Division (WMD), requested in a letter dated November 30, 1988, addressed to Detrex Corporation (received by Detrex Corporation on December 12, 1988), that a closure plan must be submitted (apart from the Act 64 Operating License Application) for the hazardous waste storage tanks at the Gold Shield Solvents', Grand Rapids facility. In response to the WMD's request, Detrex submitted a Plan of Closure, dated February 7, 1989, for the following hazardous waste management tanks at the Grand Rapids facility: two above ground, inactive, disconnected steel tanks.

The WMD conducted a facility visit on March 8, 1989. Based on the site visit and review of the February 7, 1989 Plan of Closure, the WMD further requested, in a letter dated May 2, 1989, addressed to Detrex, that the Plan of Closure be revised to include the closure of two inactive hazardous waste container storage areas at the facility. The May 2, 1989 letter also included a 'Notice of Deficiency' pertaining to the February 7, 1989 Plan of Closure. In response to the WMD's May 2, 1989 letter, this report presents a Plan of Closure for the following hazardous waste management units at the Grand Rapids facility:

i) two above ground, inactive, disconnected steel tanks; and
ii) two inactive waste container storage areas.

Figure 1 locates the Grand Rapids, Gold Shield Solvents' facility. Figure 2 presents a facility plan, locating the two inactive, disconnected hazardous waste tanks, and the two inactive waste container storage areas designated for closure.

Gold Shield Solvents historically recovered solvents from hazardous waste streams via distillation at the Grand Rapids facility. Hazardous wastes were received at the facility in 55-gallon drums. Upon receipt, all drums were dated, sampled and transferred to the appropriate area in the hazardous waste container storage areas to await recycling. (Note: An Act 64 Operating License Application was submitted on November 8, 1988 for the active hazardous waste container storage area).

Once the drum contents had been identified by specific gravity and/or chromatographic analysis, drums containing the same solvent (i.e. TCE) were transferred to the recycling area. The drum contents were charged individually into a batch distillation unit and the solvent content removed by heating the material with indirect steam. As the still level fell, additional waste was introduced until the still reboiler contained essentially only still bottoms. At this point, the still bottoms were heated to a pre-determined temperature to reduce the solvent content further. Subsequently, the still bottoms were transferred to accumulation tanks, located in the basement, to await final disposal off-Site.

The Gold Shield Solvents' hazardous waste recycling operation historically used generator accumulation tanks for the accumulation of still bottoms remaining at the end of the distillation process.

figure 1

SITE LOCATION

Detrex Corporation

Gold Shield Solvents, Grand Rapids

CRA

2471-26/01/89-7-0

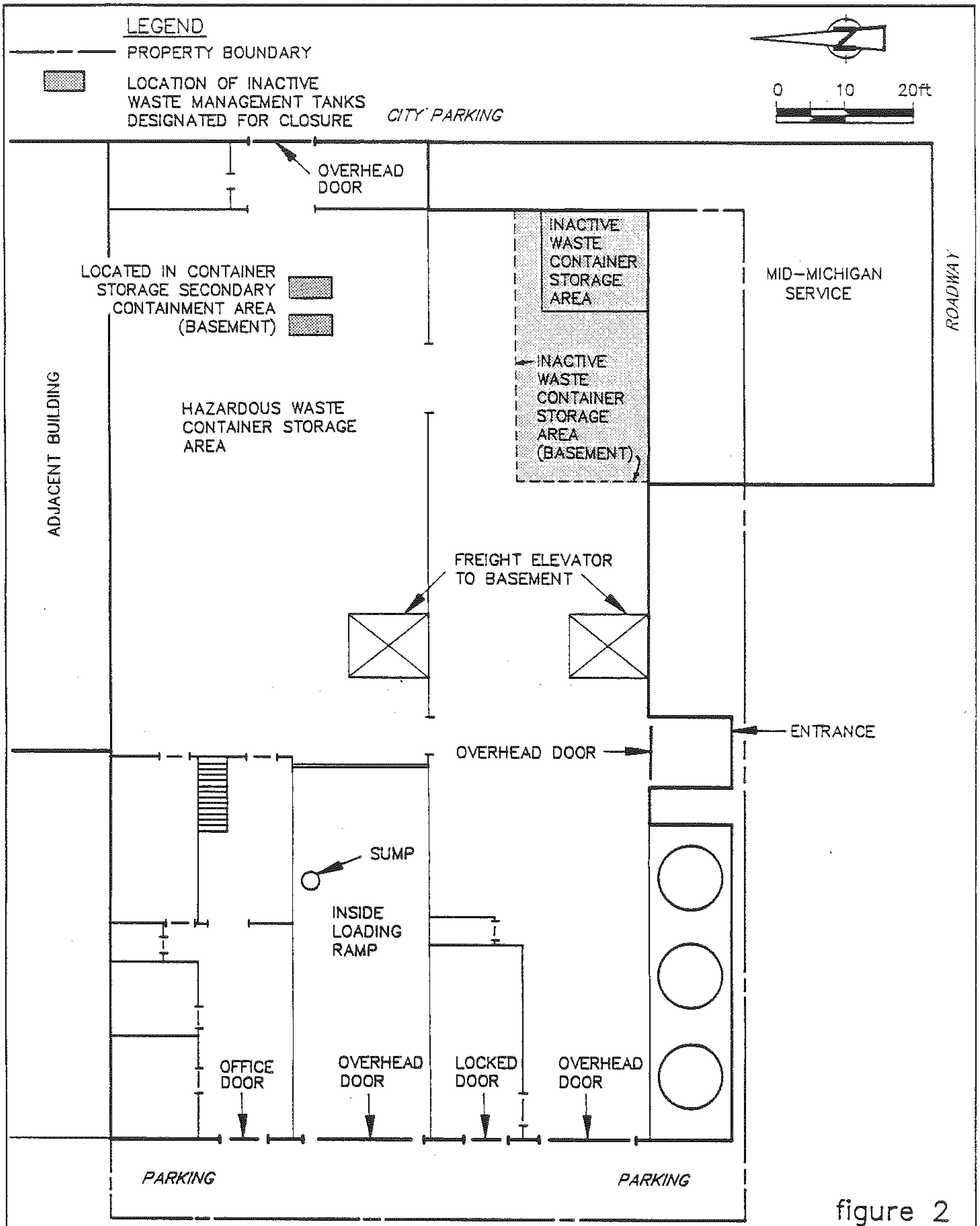

figure 2

FACILITY PLAN
Detrex Corporation
Gold Shield Solvents, Grand Rapids

CRA

2471–26/01/89–7–1

Hazardous wastes were typically stored in these tanks for less than 90 days, prior to off-site disposal/treatment. In 1987, the tank inventories were removed, piping disconnected, and the tanks cleaned.

In 1980, 1,900 gallons of design capacity for process code-S02 (tank storage) was included on Detrex Corporation's original Part A application for the Grand Rapids Gold Shield Solvents' facility. At that time, the Gold Shield Solvents' facility utilized two generator accumulation tanks (combined capacity of approximately 1,900-gallons) and Detrex mistakenly included the tank's design capacity on the original Part A application. However, based on the previously referenced letter from the MDNR, dated November 30, 1988, the WMD records indicate "...that the 'generator accumulation tanks' were included on the corporation's original Part A application and were historically used for 'accumulation' of hazardous waste for periods in excess of 90 days. Such action qualifies the 'generator accumulation tanks' as hazardous waste storage tanks." Based on the DNR's determination that the generator accumulation tanks included on the original Part A application are hazardous waste storage tanks, Detrex Corporation will close the tanks in accordance with 40 CFR § 265, Subpart G.

In 1987 Detrex consolidated all hazardous waste drum storage to the current active hazardous waste container storage area (see Figure 3). Detrex Corporation will close the two inactive hazardous waste container storage areas in accordance with 40 CFR § 265, Subpart G.

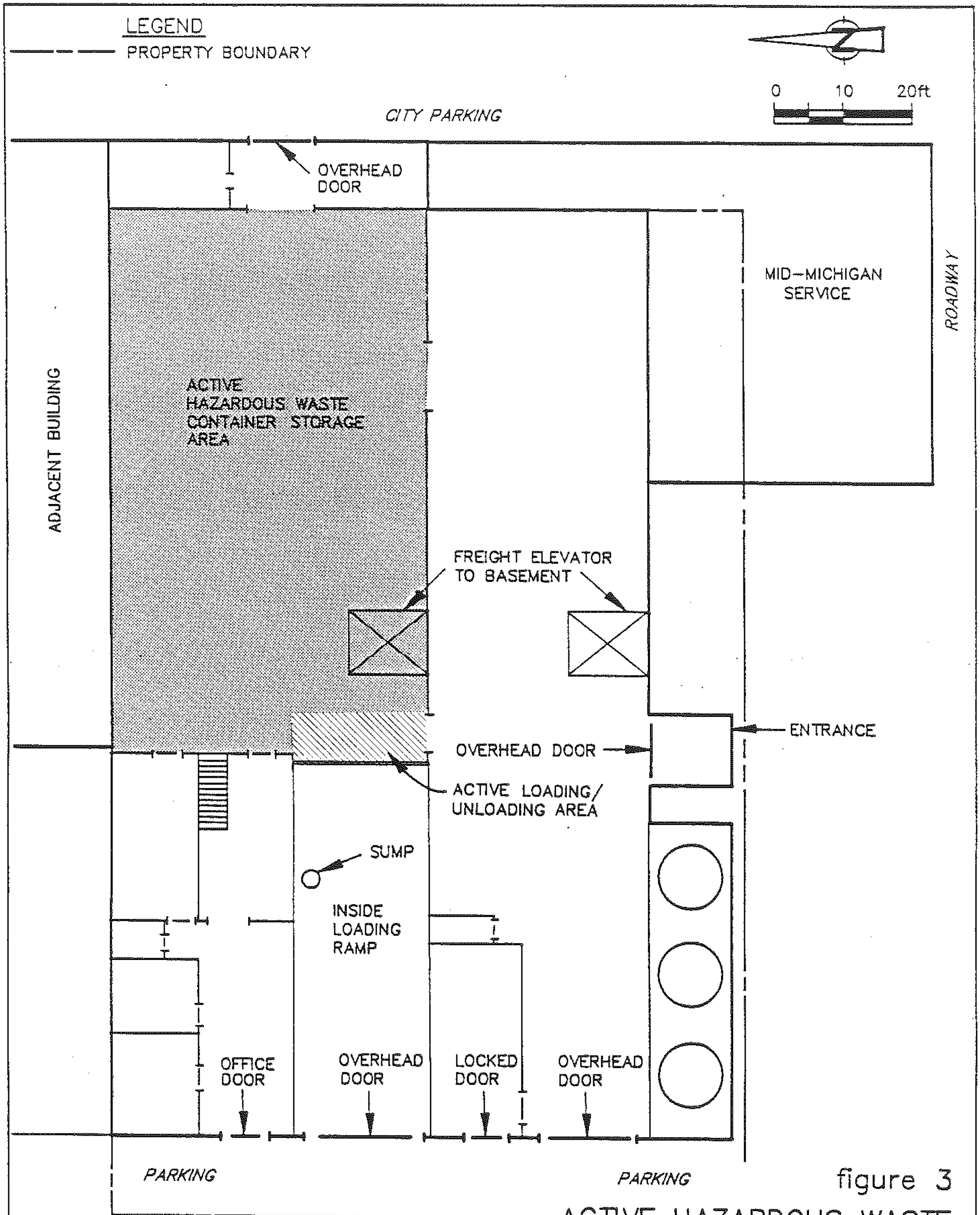

figure 3

ACTIVE HAZARDOUS WASTE CONTAINER STORAGE AREA

Detrex Corporation
Gold Shield Solvents, Grand Rapids

CRA

2471-1/06/89-7-0

1.2 CLOSURE PLAN [40 CFR § 265.112]

The closure plan for the hazardous waste tanks, and the container storage areas, designated for closure, pursuant to the requirements of 40 CFR § 265.112-265.115, is presented in Section 2.0.

The closure plan is designed to ensure that the hazardous waste management units will:

1) not require further maintenance and controls; and,

2) minimize/eliminate potential threats to human health and the environment.

Upon completion of closure activities, Detrex Corporation will submit to the Director, pursuant to the requirements of 40 CFR § 265.111, a certification by both Detrex Corporation and an independent Professional Engineer, registered in the State of Michigan, that the closure has been carried out in accordance with the approved plan.

1.3 CLOSURE COST ESTIMATE [40 CFR § 265.142]

The closure cost estimate for the hazardous waste tanks, and the container storage areas, designated for closure, pursuant to the requirements of 40 CFR § 265.142, is presented in Section 3.0.

1.4 SCHEDULE OF CLOSURE [40 CFR § 265.112, § 265.113]

The schedule of closure for the hazardous waste tanks, and the container storage areas, designated for closure, pursuant to the requirements of 40 CFR § 265.112 and § 265.113, is presented in Section 4.0.

2.0 CLOSURE OF HAZARDOUS WASTE STORAGE TANKS [40 CFR § 265.111 through § 265.115]

2.1 GENERAL

The closure of the two hazardous waste storage tanks and the two hazardous waste container storage areas, will be conducted in accordance with interim status standards 40 CFR Part 265, Subpart G.

As discussed previously, in Section 1.1, Detrex removed all tank inventory and disconnected all piping to the tanks in 1987. Also, all hazardous waste drum storage was consolidated to the current active hazardous waste container storage in 1987. Detrex is proposing to decontaminate the two hazardous waste tanks and the two hazardous waste container storage areas, under interim closure standards, and therefore, post-closure care associated with the hazardous waste units will not be required.

The following subsections describe the location and physical characteristics of each tank and the closure procedures to be adhered to.

2.2 HAZARDOUS WASTE MANAGEMENT UNIT DESCRIPTION

2.2.1 Tank Descriptions

Both tanks are open top, rectangular, carbon steel tanks and have identical capacities and dimensions. The gross capacity and dimensions of each tank is 950 gallons (effective capacity of 905 gallons) and 80 $\frac{1}{2}$" x 39" x 70", respectively. Figure 2, shows the location of the two tanks in the Gold Shield Solvents' facility. The tanks are located within the secondary containment system for the facility's hazardous waste container storage area.

The tanks were historically used for the accumulation of the F002 still bottom wastes listed on Table 1.

2.2.2 Container Storage Area Descriptions

Figure 2, presented previously, locates the two inactive container storage areas. Both container storage areas are located in the south east corner of facility.

The container storage area located in the basement, occupied an area of approximately 20 feet wide by 40 feet long. The basement, concrete floor slab, served as the base of the container storage area.

TABLE 1

HAZARDOUS WASTE SUMMARY

	EPA Hazardous Waste Number	*Hazardous Characteristic*
1,1,1 Trichloroethane	F001/F002	Toxic
Trichloroethylene	F001/F002	Toxic
Perchloroethylene	F001/F002	Toxic
Methylene Chloride	F001/F002	Toxic
Trichlorotrifluoroethane	F001/F002	Toxic

The container storage area located on the main floor occupied an area of approximately 16 feet square. The wood flooring of the building served as the base of the container storage area.

The basement provided for secondary containment for both inactive hazardous waste container storage areas.

Both container storage areas were historically used to store the F001 and/or F002 wastes listed on Table 1.

2.3 CLOSURE PROCEDURE [40 CFR § 265.112]

Closure of the two hazardous waste tanks and the two hazardous waste container storage areas will be carried out in accordance with the following procedures.

Any remaining tank sludges and tank scale, will be hand shovelled into DOT approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility.

Following removal of any remaining sludges and tank scale from each of the tanks designated for closure, Detrex will decontaminate the interior of each tank. The decontamination protocol to be followed by Detrex is summarized as follows:

a) Solvent rinse the interior of each tank with 1,1,1-Trichloroethane, and allow to air dry for 15 minutes; and

b) Steam clean the interior of each tank, repeat three times and allow to air dry for 24 hours after final rinse.

Prior to commencing tank decontamination, plastic sheeting will be placed beneath each tank. The solvent rinse and wash water will be collected from the tanks using 5-gallon pails or equivalent. The plastic sheeting will collect any solvent rinse and wash water not contained within and collected from the tank.

Following decontamination, the hazardous waste storage tanks designated for closure, may be dismantled and disposed of as non-hazardous scrap. The dismantling and disposal of the tanks is, therefore, not included under the closure cost estimate or closure schedule.

All equipment used during tank decontamination will be steam cleaned over the plastic sheeting.

All solvent rinses and wash water generated will be placed into 55 gallon DOT-approved drums for ultimate transportation off site to a permitted treatment or disposal facility. All wastes, based on Detrex's previous recycling operation, will be classified as F002 wastes.

Upon completion of the decontamination procedures of each tank and equipment, the floor area of the entire basement (north and

south halves) will be swept. All sweepings will be placed into DOT-approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility. All sweepings, based on Detrex's previous recycling and storage activities, will be classified as F002 wastes.

Subsequent to sweeping, the entire basement floor and portions of the walls (3 feet above the floor) will be washed with a high pressure detergent spray and triple rinsed with a steam cleaner. The wash water generated will be collected in the elevator pit between the north and south halves of the basement. Collected wash water will be pumped into DOT-approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility. All wash waters, based on Detrex's previous recycling and storage activities, will be classified as F002 wastes.

The wood flooring of the 16 square foot area, in the southeast corner of the main floor, will be removed and placed in DOT-approved containers (drums and/or lugger boxes) for transportation to a permitted disposal facility. All wood flooring, based on Detrex's previous recycling and storage activities, will be classified as F002 wastes.

All waste shipments will be manifested in accordance with 40 CFR Part 265, Subpart E and accompanied by notification required under 40 CFR § 268.17.

2.4 SOIL SAMPLING

The MDNR requested, in a letter dated July 25, 1988, addressed to Detrex, that Detrex develop a work plan to identify the extent of soil contamination at the Gold Shield Solvents' facility. On September 26, 1988, Detrex submitted a work plan entitled "Work Plan - Site Investigation - Gold Shield Solvents - Grand Rapids, Michigan, September 23, 1988" to the MDNR. The objectives of the Work Plan was to investigate the extent and degree of potential soil contamination resulting from past storage and handling activities at the facility. The Work Plan was reviewed and approved by the MDNR. The Work Plan is enclosed as Appendix A.

The MDNR approved Work Plan proposed eleven soil boring locations adjacent to and beneath the building facility. Two additional soil borings were added to the program during sampling activities, in order to attempt to define the aerial extent of soil contamination. In total, thirteen boreholes were completed at the site, including three boreholes in the basement of the building. Three soil samples from each boring completed on site were selected and analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH). The VOCs were analyzed following SW846 Method 8010/8020 and the TPH were analyzed using SW846 Method 8015 (modified).

The results of the Site Investigation were presented to the MDNR in a report entitled "Final Report - Site Investigation, Gold Shield Solvents, Grand Rapids, Michigan, March 30, 1989". The Final Report is enclosed as Appendix B.

The Final Report identifies that a continuous fine grained clay unit is present beneath the facility. The continuity of the clay unit was subsequently confirmed during a hydrogeologic investigation conducted at the facility during May 1989. The results of the hydrogeologic investigation will be submitted to the MDNR by June 19, 1989 in support of an operating license application. The site investigation and the hydrogeologic investigation identified fill material above the clay unit. Neither investigation identified groundwater above the clay unit. The hydraulic conductivity of the clay is currently being determined as part of the hydrogeologic investigation. The hydraulic conductivities are, however, expected to be equal to or less than 1×10^{-7} cm/sec.

Of the nine soil samples collected from the three locations beneath the building, only one at a depth of 1.0 to 2.0 feet below the floor slab, was found to have detectable concentrations of trichloroethylene (310 mg/kg). The remaining eight soil samples did not have any detectable concentrations of VOCs. The soil sample, in which trichloroethylene was detected, was collected from a borehole completed in the vicinity of the two inactive storage tanks. The Final Report concludes that with the exception of the isolated area beneath the northeast corner of the building, the past site operations have not impacted the overburden soil beneath the building.

As stated previously, the Final Report has been submitted to the MDNR for their review. Detrex has not received, at this time, any comments from the MDNR pertaining to the Final Report. Since the Work Plan was reviewed and approved by the MDNR and the objective of the soil

sampling, outlined in the Work Plan and discussed in the Final Report, was to investigate the extent and degree of potential soil contamination, Detrex is of the opinion that further soil sampling is not required. Remediation, if any, of contaminated soils identified in the Final Report, will be addressed by Detrex, subsequent to receipt of comments, pertaining to the Final Report, from the MDNR.

2.5 CLOSURE CERTIFICATION [40 CFR § 265.115]

Within 60 days of completing closure activities, Detrex Corporation will submit to the Director, certification, in the language provided in 40 CFR §270.11(d), by both Detrex Corporation and an independent Professional Engineer, registered in the State of Michigan, that the closure activities were conducted in accordance with the approved plan.

The closure certification document shall include, but not be limited to:

1. Manifests of where and how much waste was shipped;

2. Certification statement by Detrex Corporation and an independent Professional Engineer, registered in the State of Michigan.

3. Summary of decontamination procedures (solvent rinse, pressure wash, steam clean, etc.) and how rinses and waste water were disposed;

4. Results of all tests used to verify decontamination; and

6. Sampling and analysis procedures.

3.0 CLOSURE COST ESTIMATE [40 CFR § 264.142]

The total closure cost for the closure of the Detrex Corporation, Gold Shield Solvents' facility two inactive hazardous waste tanks and two inactive hazardous waste container storage areas is estimated at $44,600.00 (1989 dollars). Table 2 provides a closure cost estimate. Activities include removal of tank sludge and scale, decontamination, off-site treatment or disposal of all wastes, and closure certification.

The cost estimate assumptions made are:

1) Labor costs are presented at $25.00 per hour to account for labor costs and $30.00 per hour for supervisors. All labor rates reflect commercial rates and include fringe benefits, payroll burden and taxes.

2) Total costs include a 15% contingency for administrative and 20% contingency for miscellaneous operating costs.

TABLE 2

CLOSURE COST ESTIMATE

ITEM	*ACTIVITY*	*ESTIMATED COST*
1.	Remove, collect and drum tank sludge and scale	
	a) Labor: 1 man day @ $200/day	$200.00
	b) Supervision: 1/2 man day @ $240/day	120.00
	c) Equipment to move drummed waste to facility container storage area @ $400/day	200.00
	Sub-Total 1	$520.00
2.	Transport and off-site disposal/treatment of drummed tank sludges at a permitted facility @ $550/drum	$1,100.00
	Sub-Total 2	$1,100.00
3.	Decontaminate tanks	
	a) Labor: 2 man days @ $200/day	$400.00
	b) Supervision: 1 man day @ $240/day	240.00
	c) Equipment for decontamination and miscellaneous material handling @ $400/day	800.00
	d) Transport and off-site disposal/treatment of tank rinses: 4 drums @ $550/drum	$2,200.00
	Sub-Total 3	$3,640.00
4.	Decontaminate secondary containment area, inactive container storage areas and equipment	
	a) Labor: 6 man days @ $200/day	$1,200.00
	b) Supervision: 3 man day @ $240/day	720.00
	c) Equipment for decontamination, removal of wood flooring and miscellaneous material handling @ $400/day	1,200.00
	d) Transport and off-site disposal/treatment of sweepings, washings and wood flooring: 33 drums @ $550/drum	$18,150.00
	Sub-Total 4	$21,270.00

TABLE 2

CLOSURE COST ESTIMATE

ITEM	*ACTIVITY*	*ESTIMATED COST*
5.	Closure Certification	
	a) Professional Engineer to review final closure plans, inspect closure activities and certify closure @ $500/day	$5,000.00
	b) Disbursements including office expenses and travel expenses	1,500.00
	Sub-Total 5	$6,500.00
	Sub-Total 1, 2, 3, 4 & 5	$33,030.00
	Administration (15%)	4,960.00
	Contingency (20%)	6,610.00
	Total Estimated Final Closure Cost	$44,600.00

Notes:

1) Waste inventory has already been removed from the tanks.
2) Sludge volume estimated @ 5% of tank volume.
3) Tank rinses volumes estimated @ 10% fo tank volume.
4) Sweepings estimated @ 3 drums.
5) Basement washing volumes estimated @ 3 gallon/min for 8 hrs. = 1440 gal/day = 26 drums.
6) Wood flooring estimated @ 4 drums.
7) All costs presented in 1989 dollars.

4.0 CLOSURE SCHEDULE [40 CFR § 265.112, 265.113]

Within 90 days after receipt of final approval of the closure plan, Detrex Corporation will transport off site all tank sludges, and within 180 days after receipt of final approval of the closure plan, Detrex Corporation will complete all closure activities in accordance with the approved plan.

Also, five days prior to closure activities, the WMD Grand Rapids office and WMD Lansing Permit office will be notified.

The proposed closure schedule for tank closure activities is presented on Figure 4.

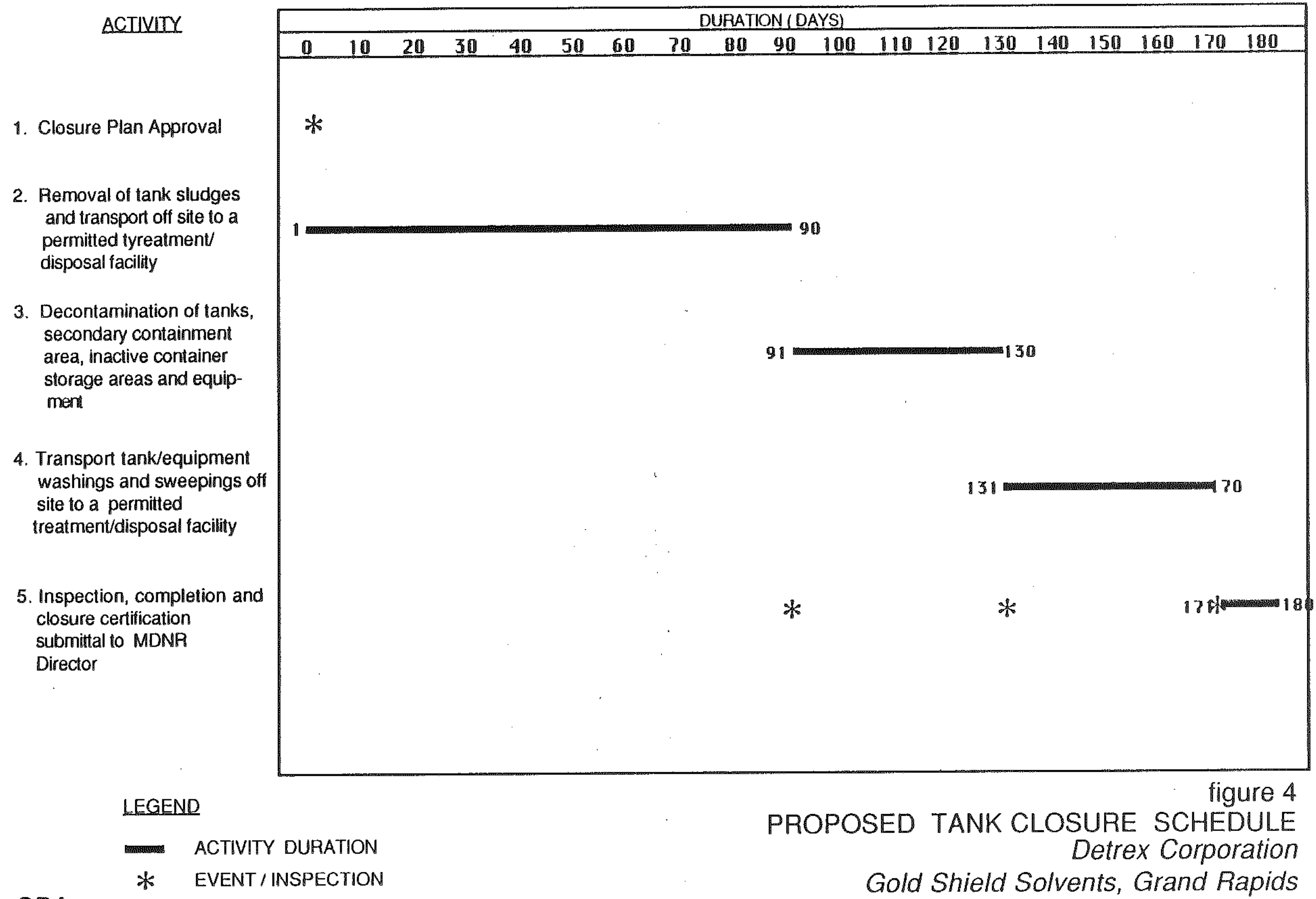

figure 4

PROPOSED TANK CLOSURE SCHEDULE

Detrex Corporation

Gold Shield Solvents, Grand Rapids

CRA

2471- 01/27/89-7-D-0

All of Which is Respectfully Submitted,

CONESTOGA-ROVERS & ASSOCIATES

Ed Roberts, P. Eng.

APPENDIX A

WORK PLAN
SITE INVESTIGATION

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1.0 INTRODUCTION

1.1 SCOPE

Gold Shield Solvents, a division of Detrex Corporation, operates a storage facility in Grand Rapids, Michigan for the storage of virgin solvents and solvent destined for recycling at other Gold Shield facilities. During an excavation on an adjacent property owned by Mid-Michigan Services, trichloroethylene and other halogenated volatile organic compounds were found in soil samples collected from within the excavation.

Based on these findings, the Michigan Department of Natural Resources (MDNR) notified Detrex on July 25, 1988 that it was the MDNR's position that their Gold Shield Solvents facility was responsible for the contaminants found within the excavation. The MDNR identified this contamination to be a violation of Act 245, P.A. of 1929, as amended. A copy of the MDNR's letter of notification is presented within Appendix A.

The MDNR required that Detrex develop a work plan outlining how the extent of the area of contamination adjacent to their facility will be defined and remediated. This work plan is to also include an implementation schedule.

The following report presents Detrex's proposed Work Plan for a site investigation at the Gold Shield Solvents facility in Grand Rapids, Michigan. The Work Plan is designed to provide a determination of the impact of past Site activities on the overburden soil. This determination is required in order to properly assess the need for remediation, if any, at the Site. Figure 1 presents a Site plan showing the property boundary and the building layout.

1.2 SITE HISTORY

1.2.1 Material Handling

Detrex's Gold Shield Solvents Division sells virgin solvents as well as recycles waste solvent for resale. The Grand Rapids facility is used as a warehouse and transfer facility for the virgin product and waste solvent storage. The solvent recycling process is not carried out at this facility.

Virgin product is stored in aboveground bulk tanks which are located outside within a concrete dyked area. Waste solvents are stored in 55 gallon drums inside the building. In the past, bulk loads of virgin solvent were

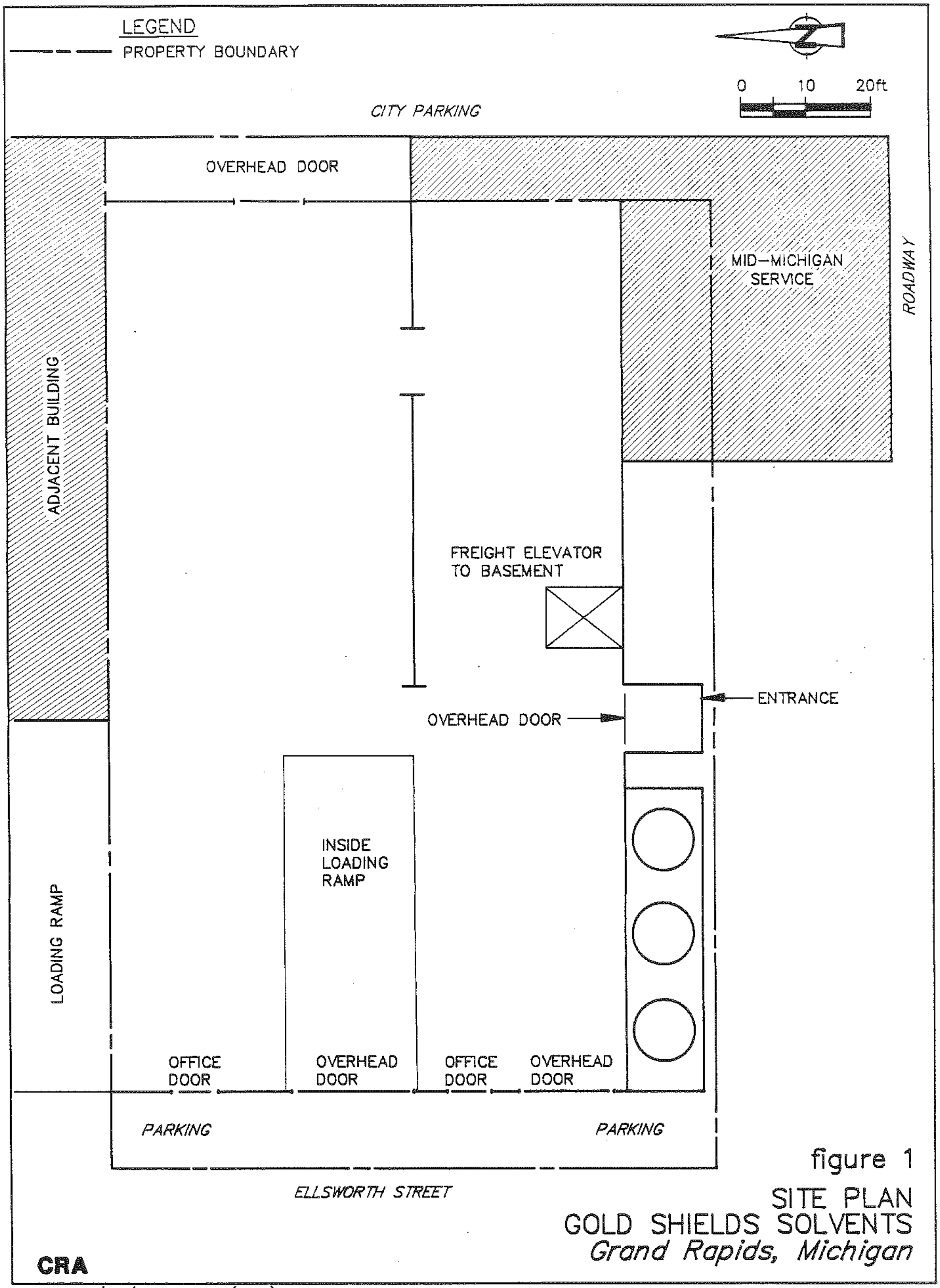


figure 1

SITE PLAN
GOLD SHIELDS SOLVENTS
Grand Rapids, Michigan

2616-16/09/88-1-F-0 (M-1)

shipped to the facility by rail in tanker cars. The transfer of this material from the tanker cars occurred along the east property boundary.

1.2.2 Site Geology

A summary of the geologic conditions at the Site has been developed through previous investigative work completed at the Site by EDI Engineering & Science. The Site and surrounding area occupies a broad area of glacial materials comprised of primarily sand and gravel interspersed with clay beds. Soil borings completed to date at the Site have encountered five to eight feet of fill material underlain by four to eight feet of silty clay. The silty clay material is underlain by three to five feet of fine grained sand. A course sand and gravel has been identified at approximately 17 feet below the ground surface down to as much as 25 feet. Groundwater has not been identified at 25 feet below the ground surface.

The lower clay unit, described as silty to sandy, soft, mottled tan to gray to yellow-brown, appears to be continuous beneath the Site. Samples collected within this clay have been found to have hydraulic conductivity values of between 1.3×10^{-8} cm/sec and 2.5×10^{-8} cm/sec. It is believed that these clays,

with the low hydraulic conductivities, will retard the vertical movement of contaminants from the overburden material through the lower clay unit.

1.2.3 Past Remedial Actions

During a routine Site inspection by representatives of the MDNR in November 1985, an area along the east side of the Grand Rapids facility was identified to have potential surface contamination caused by past Site operations. In order to address this discovery by the MDNR, Detrex developed a Work Plan for an investigation of the area. This work plan was prepared by EDI Engineering & Science and was submitted to the MDNR on January 13, 1986 in the report entitled "Work Plan for a Soils Contamination Investigation - Gold Shield Solvents - Grand Rapids, Michigan".

The Work Plan was approved by the MDNR on April 15, 1986 and EDI implemented the Work Plan in April 1986. EDI presented the results of their investigation in the report entitled "Results of Investigation of Soil Quality - Gold Shield Solvents, Division of Detrex Chemical Industries - Grand Rapids, Michigan".

Based on the results of this investigation, Detrex remediated the area east of the building. Work carried out as part of the remediation included the excavation of soil identified to have elevated levels of halogenated volatile organic compounds and the disposal of the excavated soil at Wayne Disposal in Dearborn, Michigan. A total of 312 cubic yards of soil were excavated and disposed of at Wayne Disposal. This work was completed in November 1986.

Upon completing the excavation of soil, a number of confirmatory soil samples were collected and analyzed for halogenated volatile organics. Based on the remedial efforts completed by Detrex and on the confirmatory sampling completed, the MDNR approved the remediation of the east area. Therefore, the overburden soil to the area east of the building will not be addressed under the Work Plan presented herein.

2.0 OBJECTIVES

The objective of the Work Plan is to investigate the extent and degree of soil contamination resulting from past volatile organic chemical storage and handling activities at the Grand Rapids Site.

This objective will be accomplished by the installation of eleven boreholes around and adjacent to the Site and beneath the building. The purpose of these installations are as follows:

i) to characterize the surficial geology of the Site;

ii) to determine the presence and extent of any surficial confining beds;

iii) to obtain soil samples in areas of past material handling on the property for chemical analysis to identify potential source areas of contamination.

3.0 FIELD INVESTIGATIONS/PROTOCOLS

3.1 EXPLORATION SOIL BORINGS

Exploration soil borings will be collected at 11 locations adjacent to and beneath the Grand Rapids building. Six soil borings will be drilled in areas of past material handling to delineate potential source areas on Site. In addition, three soil borings will be drilled through the building floor to confirm that the lower clay unit has not been penetrated beneath the building and to determine whether a contaminant source is present beneath the building.

At each sampling location, the borehole will be extended down to the top of the lower clay unit. Split spoon samples will be collected at two foot intervals starting at the ground surface with the last sample collected from within the lower clay unit. The split spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer, free-falling 30 inches. The driving resistance (number of hammer blows) will be recorded for each six inch increment of penetration. If the soil is loose, wet, or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between each sampling the split

spoon will be cleaned as described in Section 3.3. The collection and preparation of the soil samples are described in detail in Section 4.1 of this report.

Soil samples collected from the split spoon will be described and classified according to the Unified Soil Classification System and then stored in glass jars for geologic record. All samples retained for geologic record will be stored on Site. During sampling, HNu readings will be taken and recorded as each split spoon is opened, as an indication of volatile organic contamination.

Following completion, each borehole will be backfilled to the ground surface with cement/bentonite grout.

Figure 2 shows the proposed soil sampling locations.

3.2 WASTE HANDLING

All soil cuttings brought to the surface will be collected in 55 gallon DOT approved drums and transferred to a designated on-Site interim staging area. Any borehole fluid will also be contained and collected.

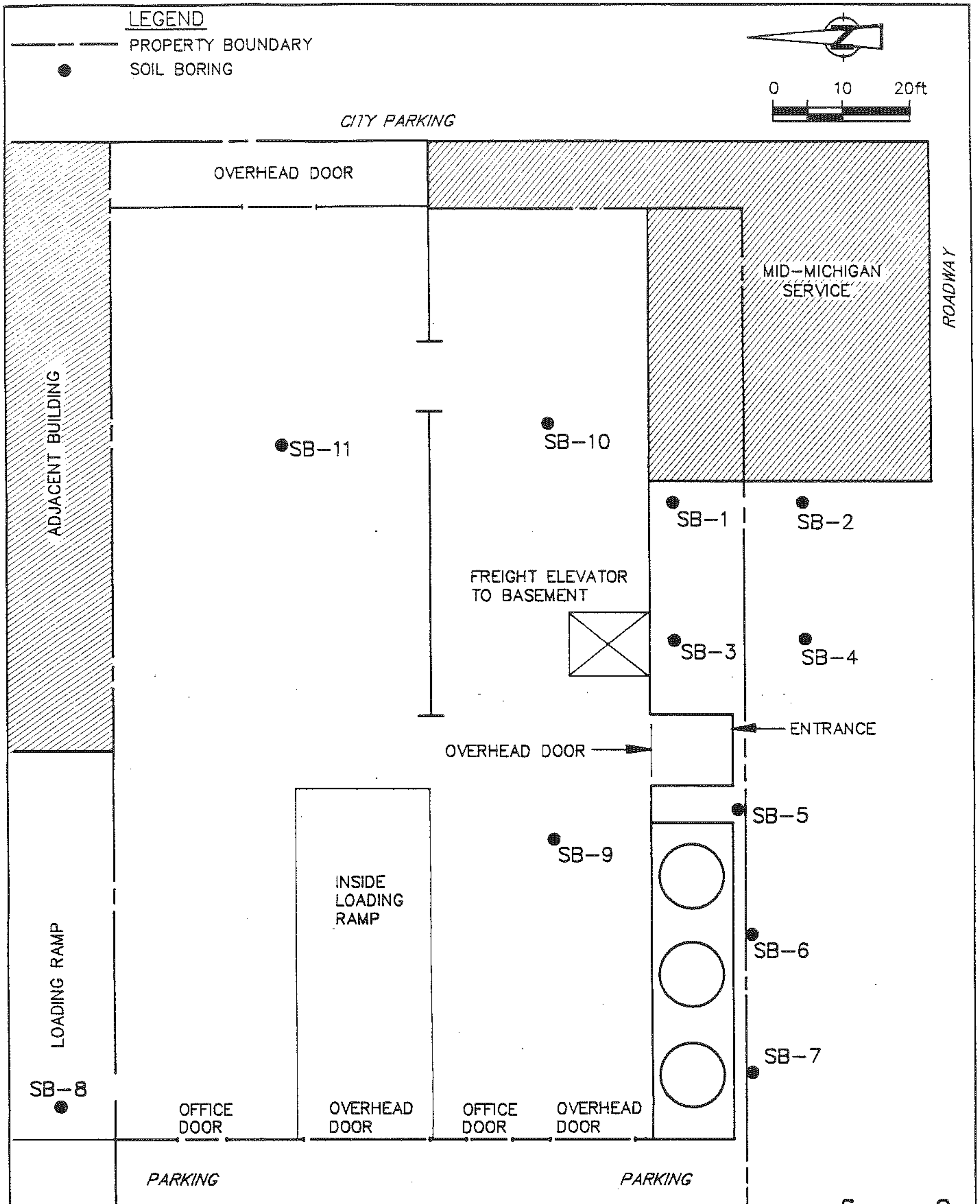


figure 2

PROPOSED SOIL SAMPLING LOCATIONS
GOLD SHIELD SOLVENTS
Grand Rapids, Michigan

2616-16/09/88-1-F-0 (M-3)

All tyveks, gloves, etc. will be collected daily in plastic bags which will be stored in the designated interim staging area.

At the completion of the field program, all waste material will be tested, analyzed and disposed of in accordance with State and Federal regulations.

3.3 EQUIPMENT CLEANING

Prior to mobilization of the drill rig, the rig and all associated equipment will be thoroughly steam cleaned to remove oil, grease, mud and other foreign matter. Subsequently, before initiating drilling at each borehole the augers, cutting bits, samplers, drill steel, and associated equipment will be cleaned to prevent cross-contamination from the previous drilling location. All cleaning will be conducted at a central area. Cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure steam wash and rinsing. Special attention will be given to the threaded sections of the drill rods and split spoons. The split spoon will be further cleaned by a isopropanol/deionized water rinse.

Following the final rinse, openings will be visually inspected to verify they are free of soil particulates and other solid material which may contribute to possible sample cross-contamination.

Equipment will be protected from all forms of solvent contact between final rinse and actual use at the sample site. All solvent rinse liquids will be segregated from wash water and disposed of in accordance with State and Federal regulations.

4.0 SAMPLING AND ANALYSIS PLAN

4.1 SOIL SAMPLING

Soil samples will be collected for chemical analyses as drilling progresses. Table 1 summarizes the number of soil samples to be taken. The sample from each split spoon will be prepared as follows:

a) The split spoon will be removed to a sample preparation station and opened.

b) Using a clean cutting tool (stainless steel knife) a thin section will be removed from the top and bottom of the core, and discarded, as shown in Figure 3.

c) The remainder of the core will then be cut longitudinally with a clean cutting tool. From the center of the core a continuous soil sample will be taken using a clean spatula. The sample will be placed into a 250-mL glass jar with teflon lid liner.

d) The remainder of the core not used for analysis will be retained in precleaned glass jars for geologic records.

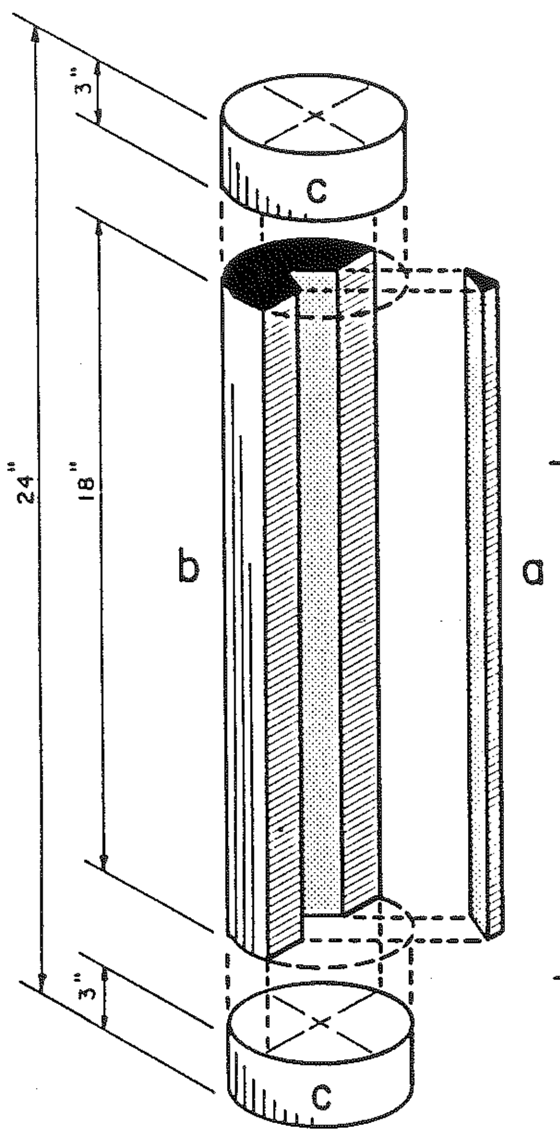
A clean pair of disposable surgical latex gloves will be used to handle each sample. Each pair of

TABLE 1

SUMMARY OF FIELD SAMPLES
GOLD SHIELD SOLVENTS
GRAND RAPIDS, MICHIGAN

	Soils
Number of samples	33*
Blind duplicates	4
Field blank	4
Matrix spike	4
Total	45

* Number of soil samples will vary with position of lower clay unit. Number presented assumes a 6 foot depth to the top of the lower clay unit.



TYPICAL SOIL CORE

a

PORTION OF SAMPLE FOR CHEMICAL ANALYSIS

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT ACCEPTABLE
- CONTAINER : PRECLEANSED 100ml. AMBER GLASS
- GASKET - TEFLON
- STORAGE - REFRIGERATED (4 °C)
- SHIPPING - ON ICE BY COURIER TO DESIGNATED LAB

b

PORTION OF SAMPLE TO BE RETAINED FOR GEOLOGIC RECORDS

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT A PROBLEM
- CONTAINER : - CLEAN GLASS JAR
  - CLEAR GLASS IS SUITABLE
- GASKET - ANY SUITABLE GASKET
- STORAGE - IN STANDARD SHIPPING CARTON
  - NO REFRIGERATION REQUIRED

c

PORTION OF SAMPLE TO BE DISCARDED

- DISCARDED WITHIN 55 GALLON DRUM MAINTAINED ON-SITE

figure 3

SOIL SAMPLE SELECTION DETAIL
GOLD SHIELD SOLVENTS
Grand Rapids, Michigan

CRA

2616-16/09/88-1-F-0

gloves will be used for no more than one sample. After retrieving a sample, latex gloves will be disposed of in a drum located on Site. At the end of the project, these materials will be disposed of in accordance with State and Federal regulations.

4.2 SAMPLE LABELING AND CONTROL

Sample labeling and control will be consistent with MDNR and USEPA requirements and CRA procedures. These procedures are discussed below.

4.2.1 Initial Labeling of Samples

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. A listing of the sample identification numbers with written descriptions of sample location, type, and date will be maintained by CRA's field personnel. The sample number system to be used is described as follows:

Example: W - AA-XXXX

where: W - designates sample type (W - water, S - soil, sediment)

AA - sampler initials

XXXX - sequential number starting with 0001

Quality Control samples will also be numbered with a unique location number.

One member of the sampling team will be responsible for recording the sampling activities for each day and will record in his log book the following with respect to each sample:

- Unique sample identification number
- Sampling location identification
- Date/time of sample collection
- Sampling data/remarks

4.2.2 Chain-of-Custody Records

CRA chain-of-custody records will be used to track all samples from the time of sampling to the arrival of samples at the laboratory. Three original copies of the chain-of-custody record will accompany the sample shipment to the laboratory and will be signed and retained by the receiving laboratory's sample custodian. A copy of the

chain-of-custody record will be retained by the shipper. Two completed copies will be returned to CRA by the laboratory. A typical chain-of-custody form is presented in Appendix B.

4.3 ANALYTICAL PROTOCOLS

4.3.1 Scope

Samples collected for chemical analysis as described in the previous sections will be analyzed for halogenated volatile organics, TPH and BTXE. All analytical work will be completed using approved USEPA methodologies as specified in the following sections.

4.3.2 Water Sample Analysis

For all field blank samples, halogenated volatile organics will be analyzed using USEPA Method 8010 as presented in SW-846 "Test Methods for Evaluating Solid Waste". Analysis for TPH will be carried out using the analytical methodology for TPH as approved by the California Regional Water Quality Control Board as referenced in their memorandum of February 2, 1987 (CRWQCB File No. 1123.64) and presented in Appendix C. Analysis of BTXE will be completed using USEPA Method 8020 as presented in SW-846.

4.3.3 Soil Analysis

Soil samples being analyzed for halogenated volatile organics and BTXE will initially be prepared using a methanol extraction as described in EPA publication SW846, "Test Methods for Evaluating Solid Wastes", published July 1982, second edition. The ratio of soil to methanol and the aliquot size will be adjusted to meet the stated quantitation limits. The extract will be analyzed using methodologies and protocols described in Section 4.3.2. Samples for TPH analysis will be analyzed using the Modified California Method as identified in Section 4.3.2 and presented in Appendix C.

5.0 ON-SITE HEALTH AND SAFETY PLAN

The sampling plan described in Sections 3 and 4 involves the collection of soil samples at the Gold Shield Solvents facility in Grand Rapids, Michigan. During the program personnel may come in contact with materials that contain halogenated volatile organics.

During the program, provisions for health and safety will be implemented which are designed to ensure:

i) that personnel working on Site are not adversely exposed to Site contaminants;

ii) that the health and safety of the general public and the environment is not compromised by off-Site migration of contaminated materials; and

iii) compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists) regulations and guidelines.

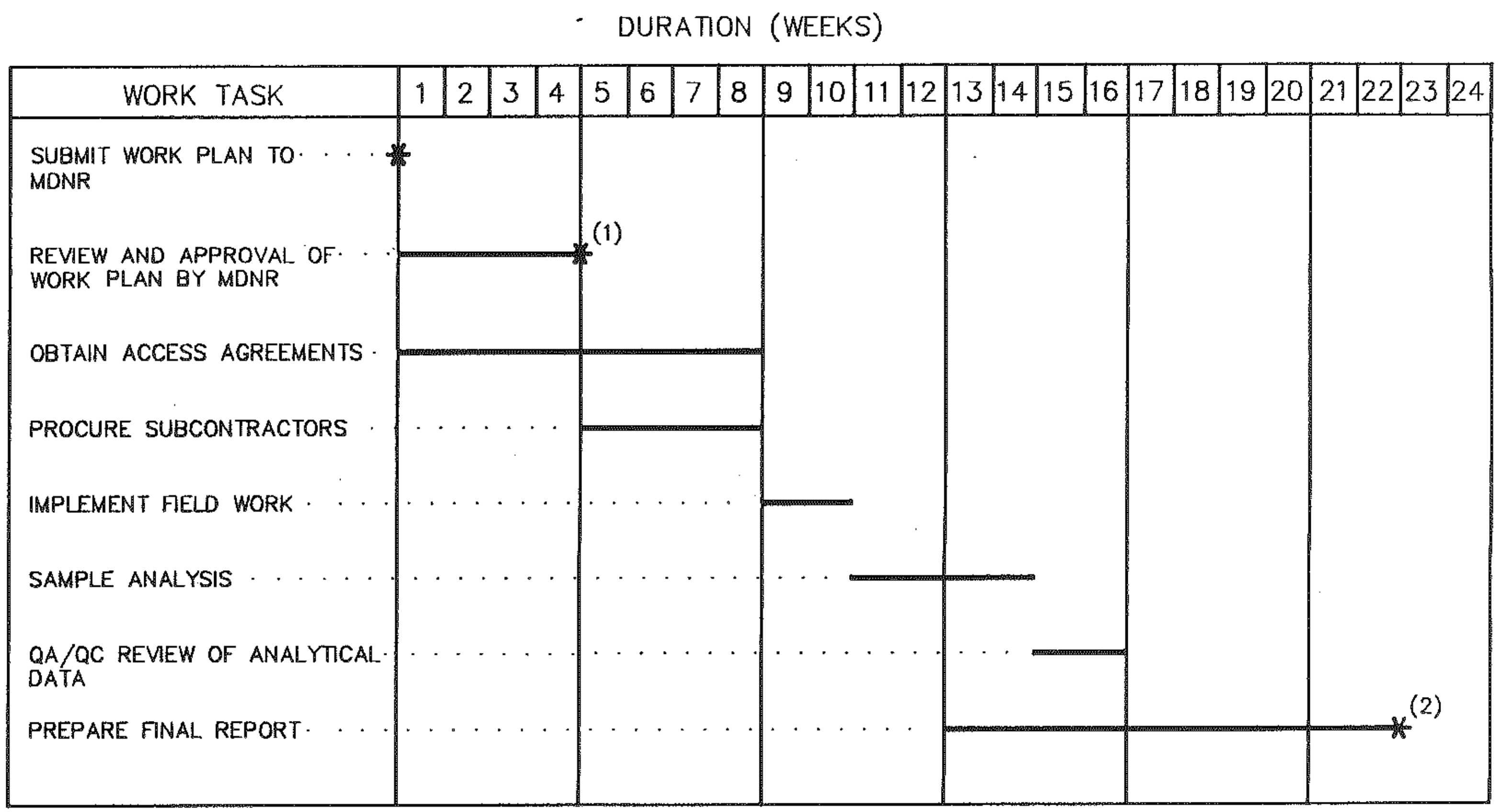
The proposed environmental Health and Safety Plan under which this work will be completed is presented in Appendix D.

6.0 IMPLEMENTATION SCHEDULE

Upon receipt of approval from the MDNR for the Work Plan presented herein, Detrex will be prepared to commence field activities within 30 days. Access agreements for the off-Site work and procurement of subcontractors will be completed during this 30 day period. It is anticipated that two weeks will be required to carry out the field investigation. Analytical data will be available for QA/QC review within 30 days of completing the field activities. Upon receipt and review of the analytical data a final report summarizing the field investigation activities and the results of the investigation will be provided to the MDNR within 45 days.

The extent of remediation at the Site, if any, can not be defined at this stage in the program. An evaluation of potential remedial action alternatives will be included as part of the final investigation report. This evaluation of potential remedial action alternatives will include implementation schedules for each alternative.

A total of 22 weeks will be required from the time that the MDNR provides approval of this Work Plan until submission of the final report. Figure 4 presents a proposed implementation schedule for this work.



NOTES:

1) MDNR APPROVAL OF WORK PLAN

2) SUBMISSION OF FINAL SITE INVESTIGATION REPORT

figure 4

PROPOSED IMPLEMENTATION SCHEDULE
GOLDSHIELD SOLVENTS
Grand Rapids, Michigan

CRA

2616-15/09/88-1-F-0 (S-1)

APPENDIX A

NOTIFICATION LETTER

J Shanahan
M Telfatti

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

David F. Hales, Director
State Office Building
350 Ottawa N. W.
Grand Rapids, Michigan 49503

July 26, 1988

CERTIFIED MAIL

Mr. Charles U. Guy
Detrex Chemical Industries, Inc.
Ashtabula, OH 44004

SUBJECT: Gold Shield Solvents Division, Ellsworth Avenue S. W.
Grand Rapids, Michigan (Kent County)

Dear Mr. Guy:

This letter will confirm our meeting of July 19, 1988 last week. As a result of an excavation on Mid-Michigan Service's property adjacent to the south of Gold Shield, soils with significant levels of TCE and other solvent compounds were found. In the past, soils contaminated with solvents, primarily TCE, were found and removed by Gold Shield from property adjacent to the east.

As stated in the meeting, it is our position that Gold Shield Solvents is responsible for this newly discovered area of contamination which is a violation of Act 245, P.A. of 1929, as amended. A work plan outlining how the extent of the area of contamination will be defined and remediated (including implementation schedule) should reach this office by August 26, 1988.

In addition, please provide us with the original "bench sheets" of the soils analysis results you collected from the excavation area. The retabulated information provided to us at the meeting is lacking some important information.

Please do not hesitate to call if you have any questions.

Sincerely,

JK Hoffmann

Jenny K. Hoffmann
Geologist
Environmental Response Division
616 - 456-5071

JKH/mam
CC: Dale DeKraker, Waste Management Division
copy to W. Graves, Mid-Michigan Service

AUG - 2 1988

R1026-1

APPENDIX B

CHAIN-OF-CUSTODY FORM

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name):

CHAIN OF CUSTODY RECORD

PROJECT Nº:

PROJECT NAME:

SAMPLER'S SIGNATURE ______________________ (SIGN)

SEQ. Nº.	SAMPLE Nº	DATE	TIME	SAMPLE LOCATION	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
				TOTAL NUMBER OF CONTAINERS			

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 ______ (SIGN)		2 ______ (SIGN)
RELINQUISHED BY: 2 ______ (SIGN)	DATE/TIME	RECEIVED BY: 3 ______ (SIGN)
RELINQUISHED BY: 3 ______ (SIGN)	DATE/TIME	RECEIVED BY: 4 ______ (SIGN)
RELINQUISHED BY: 4 ______ (SIGN)	DATE/TIME	RECEIVED BY: 5 ______ (SIGN)
RELINQUISHED BY: 5 ______ (SIGN)	DATE/TIME	RECEIVED BY: 6 ______ (SIGN)
RELINQUISHED BY: 6 ______ (SIGN)	DATE/TIME	RECEIVED BY: 7 ______ (SIGN)
RELINQUISHED BY: 7 ______ (SIGN)	DATE/TIME	RECEIVED BY: 8 ______ (SIGN)

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN) ______	DATE/TIME
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN) ______	DATE/TIME

WHITE — CRA OFFICE COPY
YELLOW — RECEIVING LABORATORY COPY
PINK — CRA LABORATORY COPY
GOLDENROD — SHIPPERS

APPENDIX C

LABORATORY PROCEDURE FOR ANALYZING FUEL HYDROCARBONS

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
1111 JACKSON STREET, ROOM 6040
OAKLAND 94607

Phone: Area Code 415
464-1255

February 2, 1987
File No. 1123.64 (TJC)

To: Underground Tank Program Implementing Agencies
And Certified Analytical Laboratories

Re: Laboratory Procedures For Analyzing Fuel Hydrocarbons

The purpose of this letter is to clarify the laboratory procedures to be used for analyzing fuel hydrocarbons, and to transmit a list of certified laboratories to local agencies.

The Regional Board Guidelines For Addressing Fuel Leaks (September 1985) contain descriptions of the analytical methods to be used for analyzing soil and groundwater samples polluted by gasoline, diesel, jet fuel, and waste oil. A copy of these methods is attached.

As explained in the Guidelines, the calibration for fuel analyses should be based upon an appropriate fuel standard that is representative of the suspect fuel. If available, a sample of the suspect fuel should be taken from the storage tank and sent to the laboratories to be used test calibration. If an appropriate aged fuel sample for calibration is not available, calibration may be done using a non-aged representative fuel sample.

Calibration should be established within the estimated range of contaminant levels in the sample, based on odor, sheen or pre-screening measurements (i.e., combustible gas indicator or I.R. methods). Where "non-detectable" concentrations are reported, the level of detection for total petroleum hydrocarbons shall not exceed 10 ppm for soil and 50 ppb for water.

As discussed in the Guidelines, a Chain of Custody record should be used whenever samples are taken which may be sent to a laboratory. We recommend that the words TOTAL FUEL HYDROCARBONS be written on the Chain of Custody under the section "Type of Analysis Requested". This will help the laboratories choose the most representitive calibration sample if one is not provided.

All soil and groundwater samples must be analyzed by a certified hazardous materials laboratory licensed to perform organic chemical analyses. Analyses by non-certified laboratories are unacceptable and as such do not provide compliance with Subchapter 16, HMMO, or Regional Board Guideline monitoring requirements. A

list of certified laboratories is attached. Certification of laboratories is an ongoing process; additional laboratories may be currently certified but not on the list. If you have any questions concerning laboratory certification please contact Dr. Fred Seto at the Department of Health Services at (415) 540-3105.

If you have any other questions please feel free to contact me at (415) 464-0838 or Tom Callaghan at (415) 464-0787.

Sincerely,

Peter W. Johnson
Section Leader
Local Program Coordination

cc: Analytical Laboratories
Local Agencies

Enclosures: Analytical Laboratory List
Local Agency List
Analytical Methods

REVISED ANALYTICAL METHODS 11/8/85

ATTACHMENT 2

ANALYTICAL PROCEDURES FOR THE DETECTION AND QUANTIFICATION OF TOTAL PETROLEUM FUEL HYDROCARBONS AND FUEL CONSITUENTS

The following analytical procedures and analysis shall be used for the detection and quantification of petroleum hydrocarbons and fuel consituents. These techniques are to be followed when analysis is required for evaluation of either a suspected or confirmed tank leak as presented in the guidelines. These analytical techniques cover the full range of petroleum fuel hydrocarbons from gasoline (C_4-C_{12}) to jet fuel (C_{10}-C_{16}), to diesel (C_9-C_{22}) in either a liquid or solid matrix. Detection of complex hydrocarbon mixtures are best achieved using a Gas Chromatograph with a Flame Ionization Detector (GC/FID).

I. TOTAL PETROLEUM FUEL HYDROCARBONS ANALYSIS
(Low to medium boiling point hydrocarbons)
This includes the full range of gasoline. This technique may also be appropriate for military grade jet fuels.

A. Sample Preparation

1. Water

Use EPA method 5020, Headspace or EPA method 5030, Purge and Trap. (EPA manual SW-846, April 1984).

2. Soil

Use EPA method 5020, Headspace or EPA method 5030, Purge and Trap. (EPA manual SW-846, April 1984). Polyethylene glycol (PEG) or Methanol can be used as a extracting solvents. Extractions are applicable for the analyses of both fresh or aged fuels.

B. Analysis

1. Chromatographic operations for detection of total petroleum fuel hydrocarbons without BTX distinction.

Detector: Flame Ionization
Column: 10 Percent SP-2100 on 80/100 Supelcort (8ft x 1/8" glass column). Capillary columns may also be used as a substitute to improve separation.

B. Analysis (cont)

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 30mL/min.
Injector Temperature: 250°C
Detector Temperature: 300°C
Column Temperature: 40°C hold for 3 minutes, 10°C/min ramp rate to 300°C or until at least 95% of all components are eluted.

B. Analysis (cont)

2. Chromatograpic operations for detection of total petroleum fuel hydrocarbons with BTX distinction.

Detector: Photo Ionization in series with Flame Ionization.
Column: Carbopack B/3 percent SP-1500

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 10mL/min.
Injector Temperature: 200°C
Detector Temperature: 250°C
Column Temperature: 100°C x 6 min to 225°C at 10°C/min hold 25 min. or until at least 95% of all components are eluted.

C. Quantification

Quantify Total Petroleum Fuel Hydrocarbons by intergrating all major peaks within the time period in which at least 95% of the recoverable hydrocarbons are eluted. Calibration shall be based upon an appropriate fuel standard representative of the suspect fuel.

If an appropriate sample for calibration does not exist, as in the case of an aged fuel, calibration shall be done using a "non-aged" representative fuel standard.

Calibration should be established within the estimated range of contaminant levels within the sample, based on odor or sheen or on prescreening measurements (i.e., combustable gas meter, or I.R. method). Where "non-detectable concentrations" are reported, the level of detection shall not exceed 10 ppm for soil and 50 ppb for water.

II. TOTAL PETROLEUM HYDROCARBONS ANALYSIS

(High boiling point hydrocarbons)
This analysis includes the range of diesel motor fuels and commerical grade jet fuels.

A. Sample Preparation

1. Water

Use EPA method 3510, Separation, (EPA manual SW-846, April 1984). Partitioning with hexane has been found to be an acceptable preparation, however other appropriate solvents may also be used.

2. Soil

Use EPA method 3550, Sonication Extraction, (EPA manual SW-846, April 1984). Acetone extraction with sample partitioning in hexane has been found to be an acceptable sample preparation, however other appropriate solvents may also be used.

B. Analysis

Chromatographic operations for detection of total petroleum fuel hydrocarbons.

Detector: Flame Ionization
Column: 10 Percent SP-2100 on 80.100 8ft x 1/8" glass supelcoport. Capillary columns may also be used as a substitute to improve seprartion.

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 30mL/min.
Injector Temperature: 250 °C
Detector Temperature: 300 °C
Column Temperature: 40 °C hold for 3 minutes, 10 °C/min ramp rate to 300 °C or until at least 95% of all components are eluted.

C. Quantification

Quantify Total Petroleum Fuel Hydrocarbons by intergrating all major peaks within the time period in which at least 95% of the recoverable hydrocarbons are eluted. Calibration shall be based upon an appropriate fuel standard representative of the suspect fuel.

If an appropriate sample for calibration does not exist, as in the case of an aged fuel, calibration shall be done using a "non-aged" representative fuel standard.

Calibration should be established within the estimated range of contaminant levels within the sample, based on odor or sheen or on prescreening measurements (i.e., combustable gas meter, or I.R. method). Where "non-detectable concentrations" are reported, the level of detection shall not exceed 10 ppm for soil and 50 ppb for water.

III. Quantification of Benzene, Toluene, and Xylene (BTX).

A. Sample Preparation

1. Water

Use EPA Method 602, or EPA method 5020, Headspace or method 5030, Purge and Trap, (EPA manual SW-846, April 1984).

2. Soil

Use EPA method 602 or EPA method 5020, Headspace or method 5030, Purge and Trap, (EPA manual SW-846, April 1984).

B. Analysis

Use EPA method 602 or 8020, (EPA manual SW-846, April 1984).

IV. Quantification of Ethylene Dibromide (1,2 Dibromoethane, EDB).

Use EPA method 601 or appropriate method in Recommended Methods for Analysis of Components in AB 1803. Pg. 301. (a), or any other Department Health Services analysis approved under the 1803 program.

V. Quantification of Tetraethyl Lead.

Use EPA method 7421 Atomic Adsorption/Graphite Furnace (AA/GF).

Results shall be reported as Total Lead.

a. Khalifa, Safy, Ph.D., Tamplin B.R. Ph.D., Spath, David, Ph.D., Recommended Methods Of Analysis For The Organic Components Required For AB 1803. Department of Health Services, State of California. May 1985

APPENDIX D

HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This project involves the collection and analysis of surface and subsurface soil samples. During these operations, personnel may come in contact with material that contains halogenated volatile organic compounds. The route of entry causing primary concern with these chemicals is through skin adsorption and/or inhalation. The possible ingestion of these compounds will be eliminated through proper hygienic practices.

The threshold limit values for select identified Site compounds are detailed in Table D-1.

The health and safety program has been developed on the basis of this information, and may be revised during the program as more information becomes available.

TABLE D-1

THRESHOLD LIMIT VALUES FOR SELECT COMPOUNDS

Compound	Threshold Limit Value (mg/L)
Trichloroethylene	50
1,1,1 Trichloroethane	350
Tetrachloroethylene	50

References:

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1985 - 1986.

This Health and Safety Plan has been designated to ensure:

1) that personnel working on Site are not adversely exposed to the above noted compounds;

2) that the health and safety of the general public and the environment is not compromised by off-Site migration of contaminated materials;

3) compliance with applicable governmental and non-govermental (American Conference of Govermental Industrial Hygienists) regulations and guidelines.

All Site operations will be conducted in accordance with the provisions of the Health and Safety Plan. Cost and/or scheduling considerations will not be considered as justification for modifying this plan.

For the purpose of this Health and Safety Plan "the work site" refers to the area of drilling and sampling operations delineated in the field by a controlled access. All material handling activities occurring in this area will be conducted using personal protective equipment (PPE). Similar activities occurring outside of the work site will be considered non-contaminated operations

requiring a modified level of PPE. Additional detail on PPE requirements is discussed in Section 6.0.

2.0 RESPONSIBILITIES AND ADMINISTRATION

A Consultants Representative shall be designated and shall be responsible for all decisions regarding operations and work stoppage due to health and safety considerations.

The Consultants Representative's health and safety responsibilities include:

- supervision and enforcement of safety equipment usage,
- supervision and inspection of equipment cleaning,
- supervision of decontamination area,
- conduct air monitoring program, on an as-required basis,
- personnel training in safety equipment usage and emergency procedures,
- implementation of safety and health program,
- has authority to suspend work activity due to unsafe working conditions,
- informs workers of the nature of chemical exposure risk as required by Right-to-Know Law,
- responsible to recommend medical examination when worker appears to require it, and
- coordination of emergency procedures.

3.0 WORKER TRAINING AND EDUCATION

Prior to commencing site activities, a formal health and safety training program will be presented.

Attendance is mandatory for all personnel who will be or are expected to be involved with the program. Visitors and other personnel not fully trained in the health and safety aspects of this program will not be allowed to enter the immediate working zone of active drilling.

This training program will ensure that each attendee understands the basic principles of personnel protection and safety, be able to perform their assigned job tasks in a safe and environmentally responsible manner, and be prepared to respond in an appropriate manner to any emergency which may arise.

This initial training will be presented by the Consultants Representative. Follow-up sessions may be presented periodically. An outline of topics covered during each session will be developed by the presenter and distributed during the initial Site training.

4.0 RESPIRATORY PROGRAM

The United States Occupational Safety & Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, part 1910.134 (29 CFR 1910.134) will provide the basis for the respiratory program. All personnel required to wear half-mask air purifying respirators shall provide proof of a pulmonary function exam and a medical approval to wear a respirator. Additionally, each individual shall be provided with his own respirator and given a qualitative fit test with either isoamyl acetate or smoke within an enclosed tent. Those failing to pass the fit test will not be allowed to work on Site.

All personnel involved in, or observing the drilling activities, shall be required to carry, as a minimum, a half-mask respirator at all times. Air monitoring conducted as described in Section 5 will determine when respiratory protection will be required.

5.0 AIR MONITORING

An HNU Organic Vapor Photoionizer, will be used to assess background and work zone concentrations of organic hydrocarbons. Readings will be collected continuously and recorded at each 5-foot advancement into the ground, (i.e. each flight of augers).

Measurements will be taken immediately adjacent to the borehole. In the event that any significant departure from general background level is measured at the breathing zone for Site personnel, the following contingency plan will be implemented for all drilling and sampling activities:

- organic vapor >10 ppm but <50 ppm
  - don half face air purifying respirators
  - increase air monitoring in immediate work zone

- organic vapor >50 ppm
  - cease work and evacuate area
  - evaluate means to reduce organic vapor emission.

Should the organic vapor level reach 5 ppm at the Site perimeter, drilling activities will cease and the source of the vapor will either be covered, removed, wetted or capped.

The air sampling instrument will be calibrated daily and/or according to manufacturer specifications or established EPA protocols. Detailed records will be kept of calibration and sampling information.

An explosimeter will be used in conjunction with all HNU monitoring activities. If the LEL is observed to exceed 20% LEL, the HNU will be deactivated, and the area will be evacuated until remedial action is taken and determined to be effective.

6.0 SITE OPERATIONS AND ORGANIZATION

The scope of work for this project involves the drilling of eleven exploratory boreholes. All active augering in soil or sampling will require as a minimum the use of the following types of PPE:

1) Disposable, Tyvek coverall with elastic cuffs,
2) Rubber gloves with cotton liners,
3) Hardhats (liners optional),
4) Safety shoes with steel toes and shanks,
5) Rubber overboots,
6) Safety glasses with side shields, and
7) Half-mask air purifying respirators equipped with combination organic vapor, and high-efficiency particulate cartridges

The Consultants Representative shall be responsible for implementing, maintaining and enforcing the PPE program. PPE will be maintained in a clean sanitary condition and ready for use. Disposable coveralls shall be discarded when torn and as an employee leaves the Site. Respirators shall be cleaned after each day's use and cartridges discarded and replaced. A sufficient quantity of

potable water shall be supplied for washing of personnel, cleaning PPE, and drinking. All sampling disposables will be disposed as deemed appropriate at the completion of the drilling program.

Additional PPE usage guidelines are as follows:

1) Prescription eyewear used on Site shall be safety glasses equipped with side shields. Contact lenses shall not be allowed on Site.

2) On Site personnel unable to pass the respirator fit testing shall not be allowed to enter or work on the Site. No facial hair is permitted on personnel who will be wearing a respirator.

3) Safety footwear and hard hats are to be worn by Site personnel at all times.

4) No watches, rings, or other accessories will be permitted during drilling/sampling activities, in accordance with general safety practices.

Site personnel also carry certain responsibilities for their own health and safety, and are required to observe the following safe work practices:

1) Familiarize themselves with the health and safety program.

2) Use the safety equipment in accordance with training received, labeling instructions and common sense.

3) Maintain safety equipment in good condition and proper working order.

4) Refrain from activities that would create additional hazards or increased opportunity for hand to mouth contact. (i.e. smoking, eating, etc. in restricted areas, leaning against dirty, potentially contaminated surfaces).

5) Soiled disposable outerwear shall be removed prior to washing hands and face, eating, using lavatory facilities, or leaving the Site.

6) All personnel involved with drilling/sampling activities will be required to wash hands, face and neck area before leaving the site at the end of the day.

7.0 DECONTAMINATION PROCEDURES

A temporary decontamination area will be established by the Consultants Representative in the field and all equipment will be cleaned in accordance with the Work Plan.

8.0 EMERGENCY AND FIRST AID EQUIPMENT AND SUPPLIES

The safety equipment listed below will be supplied for use by Site personnel and will be located in close proximity to the work zone:

1) Twenty pound ABC type dry chemical fire extinguishers. (minimum of one per drill rig)

2) First aid kit sized for a minimum of 6 people.

3) Portable eye wash.

A list of emergency response personnel (fire and police departments, ambulance, local hospital) shall be made available to the Consultants Representative and pertinent personnel. Maps of the shortest route to the selected hospital will also be made available.

APPENDIX B

FINAL REPORT

SITE INVESTIGATION

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1.0 INTRODUCTION

Gold Shield Solvents, a division of Detrex Corporation, operates a storage facility in Grand Rapids, Michigan for the storage of virgin solvents and solvent destined for recycling at other Gold Shield facilities. During an excavation on an adjacent property owned by Mid-Michigan Services, trichloroethylene and other halogenated volatile organic compounds were found in soil samples collected from within the excavation.

Based on these findings, the Michigan Department of Natural Resources (MDNR) notified Detrex on July 25, 1988 that it was the MDNR's position that their Gold Shield Solvents facility was responsible for the contaminants found within the excavation. A copy of the MDNR's letter of notification is presented within Appendix A.

The MDNR required that Detrex develop a work plan outlining how the extent of the area of contamination adjacent to their facility would be defined and remediated. This work plan was to also include an implementation schedule.

On September 26, 1988, Detrex submitted a work plan to the MDNR entitled "Work Plan - Site Investigation - Gold Shield Solvents - Grand Rapids, Michigan", Conestoga-Rovers & Associates, September 23, 1988. This document was reviewed by the MDNR, and Detrex received notice of the MDNR's approval on October 10, 1988. The sample collection, as proposed in the Work Plan, was completed during the week of December 5, 1988.

The following report presents the field observations made during the Work Plan implementation and presents the analytical data collected.

2.0 OBJECTIVES

The objective of the Site Investigation Work Plan was to investigate the extent and degree of potential soil contamination resulting from past volatile organic chemical storage and handling activities at the Grand Rapids Site. This objective was accomplished by the installation of thirteen boreholes around and adjacent to the Site and beneath the building. The purpose of these installations was as follows:

i) to characterize the surficial geology of the Site;

ii) to determine the presence and extent of any surficial confining beds; and

iii) to obtain soil samples in areas of past material handling on the property for chemical analysis to identify potential source areas of contamination.

The approved Work Plan proposed eleven soil boring locations adjacent to the Site and beneath the building. Based on field screening of the soil samples with an organic vapor analyzer (HNu), two additional soil borings were added on the south side of the building in order to attempt to define the aerial extent of soil contamination.

3.0 DESCRIPTION OF FIELD ACTIVITIES

3.1 EXPLORATION SOIL BORINGS

The firm of Sterns Drilling Inc. was retained by CRA to complete the soil borings at Detrex's Grand Rapids facility. A trailer mounted CME-45 drill rig was utilized to complete the soil borings at ten locations outside the building. A pneumatic jackhammer was used to obtain soil samples at three locations in the basement of the building. The drilling program commenced on December 6, 1988 and was completed on December 8, 1988.

Exploration soil borings were collected at thirteen locations adjacent to and beneath the Grand Rapids building. Nine soil borings were drilled in areas of past material handling to delineate potential source areas on Site. Three soil borings were drilled through the building floor to confirm that a previously identified lower clay unit has not been penetrated beneath the building and to determine whether a contaminant source is present beneath the building. A final soil boring was drilled at the northwest corner of the building in order to establish background conditions at the Site.

At each sampling location, the borehole was extended down to the top of the lower clay unit. Split spoon samples were collected at two-foot intervals starting at the ground surface with the last sample collected from within the lower clay unit. The split spoon sampler was attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound

hammer, free-falling 30 inches. The driving resistance (number of hammer blows) was recorded for each six-inch increment of penetration. Clean basket retainers were used to retain the soil in the split spoon. Between each sampling, the split spoon was cleaned as described in Section 3.2.

Soil samples collected from the split spoon were described and classified according to the Unified Soil Classification System and then stored in glass jars for geologic record. Appendix B presents the stratigraphic logs for each of the soil borings. All samples retained for geologic record have been stored on Site. During sampling, HNu readings were recorded for each split spoon as it was opened, as an indication of volatile organic contamination.

Following completion, each borehole was backfilled to the ground surface with cement/bentonite grout.

All sample preparation and handling was carried out as described in the approved Work Plan. Table 3.1 summarizes the total number of samples collected for analysis. Figure 3.1 shows the location of the thirteen soil borings completed.

3.2 EQUIPMENT CLEANING

Prior to mobilizing the drill rig, the rig and all associated equipment was thoroughly steam cleaned to remove oil, grease, mud and other foreign matter. Before initiating drilling at each borehole, the augers,

TABLE 3.1

SUMMARY OF FIELD SAMPLES
GOLD SHIELD SOLVENTS
GRAND RAPIDS, MICHIGAN

	Soils
Number of Samples	39
Blind Duplicates	4
Field Blanks (1)	4
Matrix Spikes	1
TOTAL	45

Notes:

1) Field blank consisted of deionized water poured over a split spoon following the final deionized water rinse of the decontamination protocols.

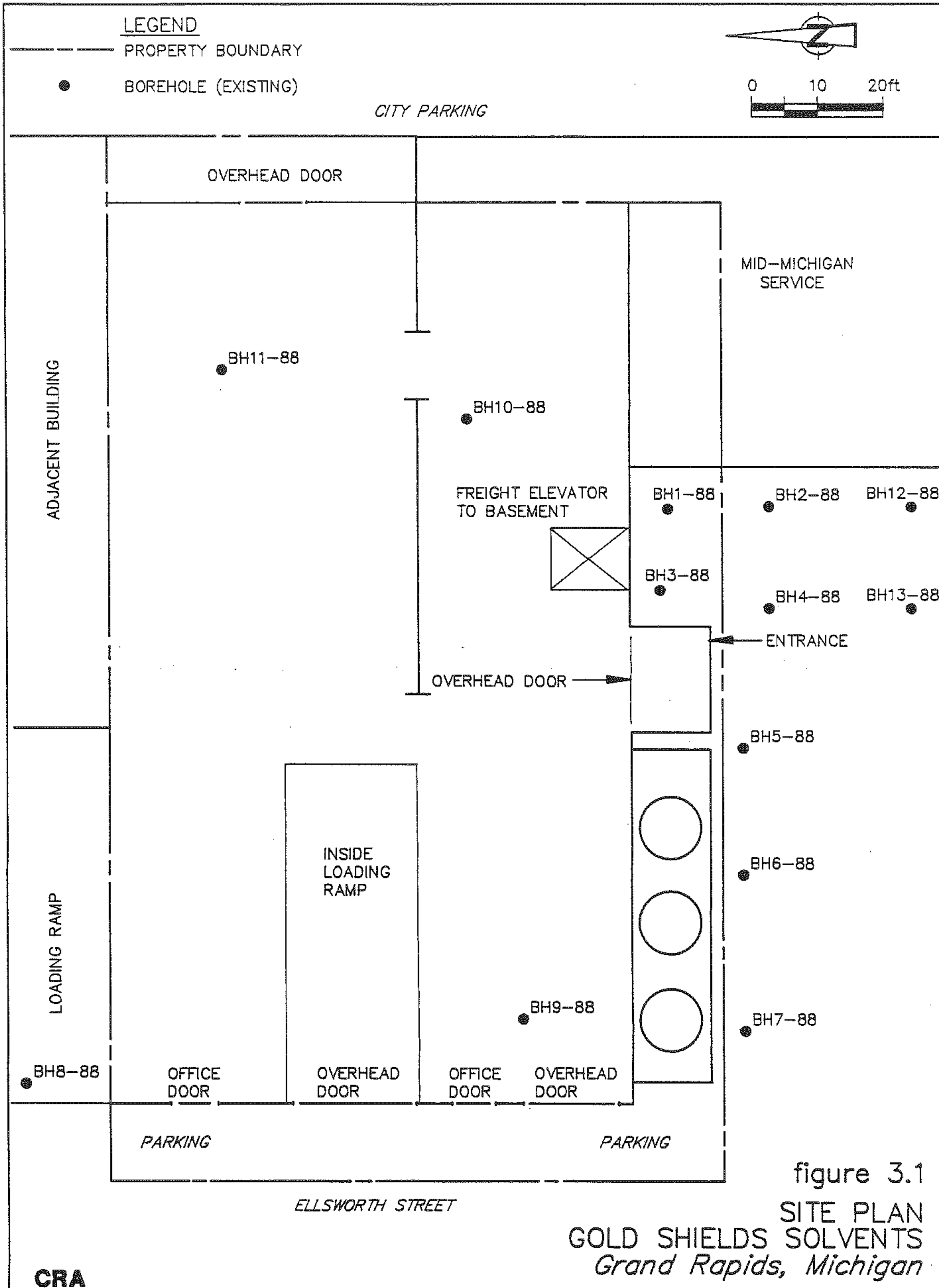


figure 3.1

SITE PLAN
GOLD SHIELDS SOLVENTS
Grand Rapids, Michigan

2616-6/03/89-2-0 (M-4)

cutting bits, samplers, drill steel and associated equipment were cleaned to prevent cross-contamination from the previous drilling location. All cleaning was conducted at a central area. Cleaning was accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure steam wash and rinsing. The split spoon samplers were further cleaned by an isopropanol/deionized water rinse after each soil sample was collected.

3.3 WASTE HANDLING

All soil cuttings brought to the surface were placed back in each borehole with a mixture of powdered bentonite clay. All soil cuttings which were not placed back into the soil boring from which they came were drummed in Federally approved DOT 55-gallon drums.

Wash water used to clean augers, samplers and all other downhole tooling was placed in DOT approved 55-gallon drums.

All disposable personal protective equipment and other Site garbage was also placed in DOT approved 55-gallon drums.

The drums were clearly labeled and placed on the shipping dock of Gold Shield Solvents pending final disposal.

4.0 FIELD OBSERVATIONS AND ANALYTICAL DATA

4.1 SITE GEOLOGY

The Site geology had previously been described by EDI Engineering & Science (EDI) based on investigative work completed by EDI at the Site in the past. A description of the Site geology was presented in the Work Plan for this Site Investigation.

The results of this most recent investigation confirm the geologic description completed by EDI, as well as expand the available information. This Site investigation confirmed the presence of a continuous layer of clay beneath the Site. The surface of this fine grained clay unit varies in depth from 5.7 feet to 8.1 feet below the ground surface. The presence of the clay unit was also confirmed beneath the building at a depth of approximately 1 to 3 feet below the basement floor. The continuity of this clay beneath the Site and the hydraulic conductivities obtained by EDI show that the clay would impede any further vertical migration of contaminants if present in the overburden soils.

The stratigraphic logs for each of the boreholes are presented in Appendix B.

4.2 ANALYTICAL DATA

4.2.1 General

All samples collected for chemical analysis were shipped under chain of custody via overnight courier (i.e. Federal Express) to Wadsworth/Alert Laboratories, Inc. (Wadsworth) of North Canton, Ohio. Samples were analyzed for volatile organic compounds (VOC's) by Wadsworth following SW846 Method 8010/8020, Third Edition. In addition, samples were analyzed for total petroleum hydrocarbons (TPH) using SW846 Method 8015 (modified).

In addition to Wadsworth's internal Quality Assurance/ Quality Control (QA/QC) procedures, CRA implemented additional QA/QC measures. These additional QA/QC measures included the collection of blind duplicate samples, rinsate blank samples and matrix spike samples.

Based on CRA's QC review of the data, the data were found to be generally acceptable with the exception of the holding times which were surpassed for many of the samples. Although the holding times were missed, the field duplicates showed good analytical precision and the matrix spike recoveries fell within the control limits established for the analytical methods. On this basis, the data is generally acceptable and can be used.

Table 4.1 presents the VOCs data for the soil samples. Table 4.2 summarizes only the positive detections for the VOCs. Table 4.3 presents the TPH data for the soil samples.

4.2.2 Data Summary

The only constituents detected in the 39 soil samples analyzed were trichloroethylene, 1,1,1-trichloroethane and TPH. Twenty of the 39 soil samples analyzed were found to have trichloroethylene present ranging from a high concentration of 920 mg/kg at BH-1 (0.6 to 2.6 feet), to a low of 1 mg/kg at BH-6 (2.5 to 4.5 feet). 1,1,1-Trichloroethane was only detected in six of the 39 samples analyzed, with a high concentration detected of 120 mg/kg at BH-3 (1.0 to 3.0 feet) and a low of 2 mg/kg at BH-7 (0.5 to 2.5 feet). Nine of the 39 soil samples analyzed were found to have TPH concentrations, with the highest concentration of 3,900 mg/kg found at BH-2 (0.4 to 2.4 feet) and the lowest of 11 mg/kg found at BH-12 (2.3 to 4.3 feet).

Of the nine soil samples collected from the three locations beneath the building, only one, BH-11 (1.0 to 2.0 feet) was found to have detectable concentrations of trichloroethylene (310 mg/kg). The remaining eight soil samples did not have any detectable concentrations of VOCs. These data show that, with the exception of an isolated area beneath the northeast corner of the building, the past Site operations have not impacted the overburden soil beneath the building.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID LOCATION	S-120788-SC-013 BH-1 (0.6-2.6')	S-120788-SC-014 BH-1 (4.6-6.6')	S-120788-SC-015 BH-1 (6.6-8.6')	S-120788-SC-016 BH-2 (0.4-2.4')	S-120788-SC-017 BH-2 (0.4-2.4') (dup. of 016)	S-120788-SC-018 BH-2 (4.4-6.4')	S-120788-SC-019 BH-2 (7.5-8.5')	S-120788-SC-020 BH-3 (1.0-3.0')	S-120788-SC-021 BH-3 (5.0-7.0')	DETECTION LIMIT (mg/kg)
Benzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Benzyl chloride	ND^^	ND++	ND	ND	ND°°	ND	ND	ND^	ND^	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND^^	ND++	ND	ND	ND°°	ND	ND	ND^	ND^	5
Bromobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromodichloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromoform	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromomethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Carbon tetrachloride	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroform	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1-Chlorohexane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
2-Chloroethyl vinyl ether	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dibromochloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dibromomethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,3-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,4-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dichlorodifluoromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1-Dichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1-Dichloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
trans-1,2-Dichloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dichloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichloropropane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
trans-1,3-Dichloropropylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Ethylbenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,2,2-Tetrachloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,1,2-Tetrachloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Tetrachloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Toluene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,1-Trichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	120	65	1
1,1,2-Trichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Trichloroethylene	920	32	2	3	97	15	2	220	120	1
Trichlorofluoromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Trichloropropane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Vinyl chloride	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Xylenes	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID *LOCATION*	*S-120788-SC-022* *BH-3 (7.0-9.0')*	*S-120788-SC-010* *BH-4 (0.3-2.3')*	*S-120788-SC-011* *BH-4 (4.3-6.3')*	*S-120788-SC-012* *BH-4 (6.3-8.3')*	*S-120788-SC-023* *BH-5 (1.8-3.8')*	*S-120788-SC-025* *BH-5 (5.8-7.8')*	*S-120788-SC-026* *BH-5 (9.0-9.8')*	*S-120888-SC-027* *BH-6 (0.5-2.5')*	*S-120888-SC-028* *BH-6 (2.5-4.5')*	*DETECTION LIMIT (mg/kg)*
Benzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND++	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND++	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	ND+	ND	ND	6	ND	ND	5	4	1
1,1,2-Trichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	2	20	4	ND	10	2	ND	3	1	1
Trichlorofluoromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID *LOCATION*	*S-120888-SC-029* *BH-6 (8.0-8.5')*	*S-120888-SC-030* *BH-7 (0.5-2.5')*	*S-120888-SC-031* *BH-7 (2.5-4.5')*	*S-120888-SC-032* *BH-7 (4.5-6.5')*	*S-120888-SC-041* *BH-8 (0.4-2.4')*	*S-120888-SC-042* *BH-8 (4.4-6.4')*	*S-120888-SC-043* *BH-8 (6.4-8.4')*	*S-120888-SC-044* *BH-8 (10.4-12.4')*	*S-120688-SC-007* *BH-9 (0.4-1.0')*	*DETECTION LIMIT (mg/kg)*
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	2	ND	ND	ND	ND	ND	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	ND	2	ND	ND	ND	ND	ND	ND	ND	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID / LOCATION	S-120688-SC-008 BH-9 (0.4-1.0') (dup. of 007)	S-120688-SC-009 BH-9 (4.0-4.5')	S-120688-SC-004 BH-10 (0.4-1.0')	S-120688-SC-005 BH-10 (1.5-2.2')	S-120688-SC-006 BH-10 (2.2-2.8')	S-120688-SC-001 BH-11 (0.3-1.0')	S-120688-SC-002 BH-11 (1.0-2.0')	S-120688-SC-003 BH-11 (3.0-3.5')	S-120888-SC-033 BH-12 (0.3-2.3')	DETECTION LIMIT (mg/kg)
Benzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND**	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND**	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Trichloroethylene	ND	ND	ND	ND	ND	ND	310	ND	2	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID	*S-120888-SC-034*	*S-120888-SC-035*	*S-120888-SC-036*	*S-120888-SC-037*	*S-120888-SC-038*	*S-120888-SC-039*	*S-120888-SC-040*	*DETECTION*
LOCATION	*BH-12 (2.3-4.3')*	*BH-12 (2.3-4.3')*	*BH-12 (6.3-8.3')*	*BH-13 (0.5-2.5')*	*BH-13 (4.5-6.5')*	*BH-13 (6.5-8.5')*	*BH-13 (6.5-8.5')*	*LIMIT*
		(dup. of 034)					*(dup. of 039)*	*(mg/kg)*
Benzene	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	8	8	ND	25	ND	ND	ND	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.2
SUMMARY OF POSITIVE DETECTIONS - VOC'S
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

LOCATION	*TRICHLOROETHYENE*	*1,1,1-TRICHLOROETHANE*
BH-1 (0.6-2.6')	920	ND(50)
BH-1 (4.6-6.6')	32	ND(3)
BH-1 (6.6-8.6')	2	ND(1)
BH-2 (0.4-2.4')	3/97	ND/ND (1)/(5)
BH-2 (4.4-6.4')	15	ND(1)
BH-2 (7.5-8.5')	2	ND(1)
BH-3 (1.0-3.0')	220	120
BH-3 (5.0-7.0')	120	65
BH-3 (7.0-9.0')	2	ND(1)
BH-4 (0.3-2.3')	20	ND(3)
BH-4 (4.3-6.3')	4	ND(1)
BH-4 (6.3-8.3')	ND(1)	ND(1)
BH-5 (1.8-3.8')	10	6
BH-5 (5.8-7.8')	2	ND(1)
BH-5 (9.0-9.8')	ND(1)	ND(1)
BH-6 (0.5-2.5')	3	5
BH-6 (2.5-4.5')	1	4
BH-6 (8.0-8.5')	ND(1)	ND(1)
BH-7 (0.5-2.5')	2	2
BH-7 (2.5-4.5')	ND(1)	ND(1)
BH-7 (4.5-6.5')	ND(1)	ND(1)
BH-8 (0.4-2.4')	ND(1)	ND(1)
BH-8 (4.4-6.4')	ND(1)	ND(1)
BH-8 (6.4-8.4')	ND(1)	ND(1)
BH-8 (10.4-12.4')	ND(1)	ND(1)
BH-9 (0.4-1.0')	ND/ND (1)/(1)	ND/ND (1)/(1)
BH-9 (4.0-4.5')	ND(1)	ND(1)
BH-10 (0.4-1.0')	ND(1)	ND(1)
BH-10 (1.5-2.2')	ND(1)	ND(1)
BH-10 (2.2-2.8')	ND(1)	ND(1)
BH-11 (0.3-1.0')	ND(1)	ND(1)
BH-11 (1.0-2.0')	310	ND(20)
BH-11 (3.0-3.5')	ND(1)	ND(1)
BH-12 (0.3-2.3')	2	ND(1)
BH-12 (2.3-4.3')	8/8	ND/ND (1)/(1)
BH-12 (6.3-8.3')	ND(1)	ND(1)
BH-13 (0.5-2.5')	25	ND(1)
BH-13 (4.5-6.5')	ND(1)	ND(1)
BH-13 (6.5-8.5')	ND/ND (1)/(1)	ND/ND (1)/(1)

Notes: 1) ND - Not detected at stated limit of detection.
2) ( ) - Number shown in brackets is detection limit.
3) 3/97 - Second number shown is duplicate analysis.

TABLE 4.3
ANALYTICAL DATA SUMMARY - TPH (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID	*LOCATION*		*RESULT*	*DETECTION LIMIT*
S-120788-SC-013	BH-1 (0.6-2.6')		710	30
S-120788-SC-014	BH-1 (4.6-6.6')		660	30
S-120788-SC-015	BH-1 (6.6-8.6')		ND	10
S-120788-SC-016	BH-2 (0.4-2.4')		739	20
S-120788-SC-017	BH-2 (0.4-2.4')	(dup. of 016)	3900	40
S-120788-SC-018	BH-2 (4.4-6.4')		890	20
S-120788-SC-019	BH-2 (7.5-8.5')		ND	10
S-120788-SC-020	BH-3 (1.0-3.0')		120	20
S-120788-SC-021	BH-3 (5.0-7.0')		ND	20
S-120788-SC-022	BH-3 (7.0-9.0')		ND	10
S-120788-SC-010	BH-4 (0.3-2.3')		3000	30
S-120788-SC-011	BH-4 (4.3-6.3')		193	30
S-120788-SC-012	BH-4 (6.3-8.3')		ND	10
S-120788-SC-023	BH-5 (1.8-3.8')		ND	10
S-120788-SC-025	BH-5 (5.8-7.8')		ND	10
S-120788-SC-026	BH-5 (9.0-9.8')		ND	10
S-120888-SC-027	BH-6 (0.5-2.5')		ND	10
S-120888-SC-028	BH-6 (2.5-4.5')		ND	10
S-120888-SC-029	BH-6 (8.0-8.5')		ND	10
S-120888-SC-030	BH-7 (0.5-2.5')		ND	10
S-120888-SC-031	BH-7 (2.5-4.5')		ND	10
S-120888-SC-032	BH-7 (4.5-6.5')		ND	10
S-120888-SC-041	BH-8 (0.4-2.4')		ND	10
S-120888-SC-042	BH-8 (4.4-6.4')		ND	10
S-120888-SC-043	BH-8 (6.4-8.4')		ND	10
S-120888-SC-044	BH-8 (10.4-12.4')		ND	10
S-120688-SC-007	BH-9 (0.4-1.0')		ND	10
S-120688-SC-008	BH-9 (0.4-1.0')	(dup. of 007)	ND	10
S-120688-SC-009	BH-9 (4.0-4.5')		ND	10
S-120688-SC-004	BH-10 (0.4-1.0')		ND	10
S-120688-SC-005	BH-10 (1.5-2.2')		ND	10
S-120688-SC-006	BH-10 (2.2-2.8')		ND	10
S-120688-SC-001	BH-11 (0.3-1.0')		ND	10
S-120688-SC-002	BH-11 (1.0-2.0')		ND	10
S-120688-SC-003	BH-11 (3.0-3.5')		ND	10
S-120888-SC-033	BH-12 (0.3-2.3')		ND	10
S-120888-SC-034	BH-12 (2.3-4.3')		11	10
S-120888-SC-035	BH-12 (2.3-4.3')	(dup. of 034)	15	10
S-120888-SC-036	BH-12 (6.3-8.3')		ND	10
S-120888-SC-037	BH-13 (0.5-2.5')		38	10
S-120888-SC-038	BH-13 (4.5-6.5')		ND	10
S-120888-SC-039	BH-13 (6.5-8.5')		ND	10
S-120888-SC-040	BH-13 (6.5-8.5')	(dup. of 039)	ND	10

For the soil samples collected outside of the building, trichloroethylene and 1,1,1-trichloroethane were found at their highest concentrations at the ground surface and at the boreholes located in the southeast corner by Mid-Michigan Services. The concentrations of trichloroethylene and 1,1,1-trichloroethane were much lower in the deeper soil samples, and were detected in only three of the ten samples collected at the overburden/clay interface. The exact southerly extent of VOCs in the soil was not clearly delineated by the soil borings completed. The results of these soil analyses indicate that some spillage of VOCs may have occurred, primarily at the southeast corner of the building, with the possibility of small amounts along the aboveground tanks. However, it appears that the asphalt cover over this entire area is minimizing any surface water infiltration, thereby minimizing the vertical migration of the VOCs detected.

There were no VOCs detected in the background borehole (BH-8). This indicates that the presence of VOCs in the overburden soils is isolated to the immediate areas of past and present material handling.

The TPH found in the soil samples analyzed were isolated to the soil borings completed at the southeast corner of the building by Mid-Michigan Services. There is evidence of oil or gasoline spillage in this area. The TPH concentrations, as was the case for VOCs, are highest at the surface and decline vertically through the overburden. There were no TPH concentrations found at the overburden/clay interface. The distribution of TPH concentrations also indicates that the asphalt cover in the area is minimizing the vertical migration of the TPH.

5.0 CONCLUSIONS

Based on the sampling and analytical work completed at the Gold Shield Solvents Site in Grand Rapids, Michigan, the following conclusions are presented:

a) The Site geology described by EDI during previous investigative work was generally confirmed by this study, however, some clay or silty fill material was identified within the overburden. The overburden was comprised of an assortment of fine grained sands and some gravels.

b) A fine grained clay was identified in all of the soil borings completed. The presence of this fine grained clay in all of the borings indicates that the clay is continuous beneath the Site. The continuity of the clay and the hydraulic conductivities previously determined by EDI show that the clay would impede any further vertical migration of the contaminants detected.

c) Concentrations of trichloroethylene, 1,1,1-trichloroethane and total petroleum hydrocarbons (TPH) have been identified in overburden soils adjacent to the south side of the Gold Shield Solvents building and at one isolated location beneath the building. The concentrations of trichloroethylene, 1,1,1-trichloroethane and TPH decline vertically through the overburden to the overburden/clay interface. The asphalt cover over the areas found to be contaminated appears to be effective in minimizing the infiltration of surface water and thereby minimizing the vertical migration of contaminants.

APPENDIX A

NOTIFICATION LETTER

J. Shamillen
M. Tsiatsi

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

David F. Hales, Director
State Office Building
350 Ottawa N. W.
Grand Rapids, Michigan 49503

July 25, 1988

CERTIFIED MAIL

Mr. Charles U. Guy
Detrex Chemical Industries, Inc.
Ashtabula, OH 44004

SUBJECT: Gold Shield Solvents Division, Ellsworth Avenue S. W.
Grand Rapids, Michigan (Kent County)

Dear Mr. Guy:

This letter will confirm our meeting of July 19, 1988 last week. As a result of an excavation on Mid-Michigan Service's property adjacent to the south of Gold Shield, soils with significant levels of TCE and other solvent compounds were found. In the past, soils contaminated with solvents, primarily TCE, were found and removed by Gold Shield from property adjacent to the east.

As stated in the meeting, it is our position that Gold Shield Solvents is responsible for this newly discovered area of contamination which is a violation of Act 245, P.A. of 1929, as amended. A work plan outlining how the extent of the area of contamination will be defined and remediated (including implementation schedule) should reach this office by August 26, 1988.

In addition, please provide us with the original "bench sheets" of the soils analysis results you collected from the excavation area. The retabulated information provided to us at the meeting is lacking some important information.

Please do not hesitate to call if you have any questions.

Sincerely,

JK Hoffman

Jenny K. Hoffmann
Geologist
Environmental Response Division
616 - 456-5071

JKH/mam
CC: Dale DeKraker, Waste Management Division
copy to W. Graves, Mid-Michigan Service

AUG - 2 1988

R1026-1

APPENDIX B

STRATIGRAPHIC LOGS

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME:	GOLDSHIELD SOLVENTS	HOLE DESIGNATION:	BH1-88 (PAGE 1 of 2)
PROJECT NO.:	2616	DATE COMPLETED:	DECEMBER 7, 1988
CLIENT:	DETREX CORPORATION	DRILLING METHOD:	3 1/4" ID HSA
LOCATION:	AS PER PLAN	CRA SUPERVISOR:	S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete		7.0"ø BOREHOLE				
1.0	SW(FILL)SAND, some gravel, some silt, dense, well graded, clay lumps, moist, brown, strong solvent odor from surface	-0.6	CEMENT/ BENTONITE GROUT	1SS		23	440
2.0							
3.0	CL(FILL)CLAY, some silt, firm, very moist, brown, solvent odor, low plastic	-3.1		2SS		16	380
4.0							
5.0	Slight solvent odor			3SS		4	200
6.0							
7.0	CL(CLAY) some silt, little sand, trace gravel, firm, nuggetty, low plastic, mottled gray/brown, remoulded with secondary clay mineralization along horizontal and vertical fissures, moist, slight odor	-6.9		4SS		12	200
8.0							
9.0	Brown, nuggetty, odorless			5SS		24	200
10.0							
11.0				6SS		33	180
12.0							
13.0	CL(TILL)CLAY, some silt, some sand, little gravel, stiff, low plastic, brown, moist, odorless	-12.8		7SS		31	

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH1-88 (PAGE 2 of 2)
DATE COMPLETED: DECEMBER 7, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	CL(TILL)CLAY, some silt, some sand, little gravel, stiff, low plastic, brown, moist, odorless		7.0"ø BOREHOLE; CEMENT/ BENTONITE GROUT	7SS	X	31	
14.0							
	END OF HOLE @ 14.6 FT. BGS	-14.6					
15.0	NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.						
16.0							
17.0							
18.0							
19.0							
20.0							
21.0							
22.0							
23.0							
24.0							
25.0							
26.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH2–88
DATE COMPLETED: DECEMBER 7, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete						
	ML–GM(FILL) Silt, some gravel, some sand, compact, solvent odor	−0.4	7.0"ø BOREHOLE				
1.0							
			CEMENT/ BENTONITE GROUT	1SS		27	460
2.0							
3.0							
	CL fill, stiff, brown, solvent odor			2SS		21	380
4.0							
5.0							
	Same, except with rocks, brick, wood			3SS		34	260
6.0							
7.0							
	Same, except with coal seam at 7.6'			4SS		10	200
8.0	CL(CLAY)TILL, some silt, little sand, trace gravel, firm, low plastic, brown, slight solvent odor	−7.8					
9.0							
				5SS		11	40
10.0							
	END OF HOLE @ 10.4 FT. BGS	−10.4					
11.0	NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.						
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
HOLE DESIGNATION: BH3-88

PROJECT NO.: 2616
DATE COMPLETED: DECEMBER 7, 1988

CLIENT: DETREX CORPORATION
DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete		7.0"ø BOREHOLE				
1.0	ML-CL(FILL) SILT&CLAY, some sand, some gravel, firm, brown and black, low plastic, inclusions of bricks, glass, bones, solvent odor	-1.0	CEMENT/ BENTONITE GROUT				
2.0				1SS		12	250
3.0							
4.0				2SS		5	180
5.0							
6.0	Clean fill, no inclusions, slight solvent odor			3SS		7	180
7.0							
8.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low to medium plastic, brown, odorless	-8.1		4SS		10	50
9.0							
10.0				5SS		12	50
11.0	END OF HOLE @ 11.0 FT. BGS	-11.0					
12.0	NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.						
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

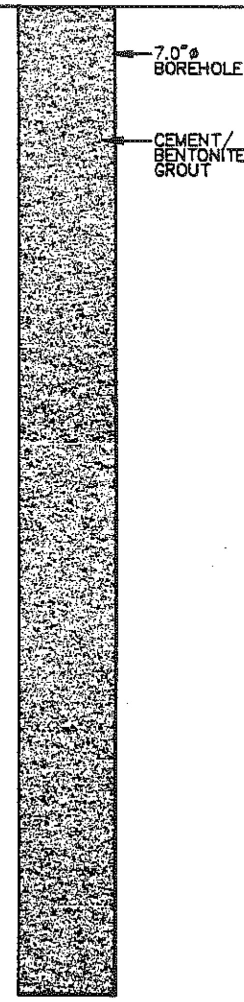
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH4-88
DATE COMPLETED: DECEMBER 7, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	STATE	'N' VALUE	* HNu
	Asphalt	-0.3				
1.0	ML(FILL)SILT&CLAY, some sand, some gravel, stiff, cohesive, brown and black, moist, petroleum odor at surface		1SS		51	80
2.0						
3.0			2SS		15	130
4.0	Same, except with pieces of metal, coal, wood chips, not as stiff, sand seams					
5.0	Same, except with slight petroleum odor, moist		3SS		25	20
6.0						
7.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, mottled gray/brown, moist, occasional vertical and horizontal fissure with secondary clay mineralization, odorless	-7.1	4SS		16	25
8.0						
9.0	Clay mineralization, odorless		5SS		12	20
10.0		-10.3				
11.0	END OF HOLE @ 10.3 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.					
12.0						
13.0						

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS | HOLE DESIGNATION: BH5-88
PROJECT NO.: 2616 | DATE COMPLETED: DECEMBER 8, 1988
CLIENT: DETREX CORPORATION | DRILLING METHOD: 3 1/4" ID HSA
LOCATION: AS PER PLAN | CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	STATE	'N' VALUE	* HNU
	Concrete, after breaking through strong solvent odor noticed					
1.0						
2.0	CL(CLAY)FILL, some silt, some sand, little gravel, firm, medium plastic, brown, strong solvent odor	-1.8				
3.0			1SS	X	8	450
4.0						
5.0	Same, except with seam of cinders, sand, bricks		2SS	X	11	480
6.0						
7.0	Same, except with slight solvent odor		3SS	X	6	180
8.0	CL(TILL)CLAY, some silt, little sand, trace gravel, firm, medium plastic, brown, moist, slight solvent odor	-7.5				
9.0			4SS	X	19	150
10.0	END OF HOLE @ 9.8 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.	-9.8				
11.0						
12.0						
13.0						

MONITOR INSTALLATION

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS — HOLE DESIGNATION: BH6-88

PROJECT NO.: 2616 — DATE COMPLETED: DECEMBER 8, 1988

CLIENT: DETREX CORPORATION — DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN — CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete						
	GS-SW(FILL)(SAND&GRAVEL), some silt, compact, well graded, black, solvent odor, moist	-0.5	7.0"ø BOREHOLE				
1.0			CEMENT/ BENTONITE GROUT	1SS		19	45
2.0	CL(FILL)CLAY, some silt, soft, medium plastic, brown, occasional brick, solvent odor	-2.1					
3.0				2SS		5	45
4.0							
5.0	Very moist, slight solvent odor			3SS		6	30
6.0							
7.0	Moist, odorless			4SS		8	20
8.0	CL(CLAY)TILL, some silt, little sand, trace gravel, stiff, low plastic, brown, moist, odorless	-7.9					
9.0				5SS		12	10
10.0							
	END OF HOLE @ 10.5 FT. BGS	-10.5					
11.0	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
HOLE DESIGNATION: BH7-88

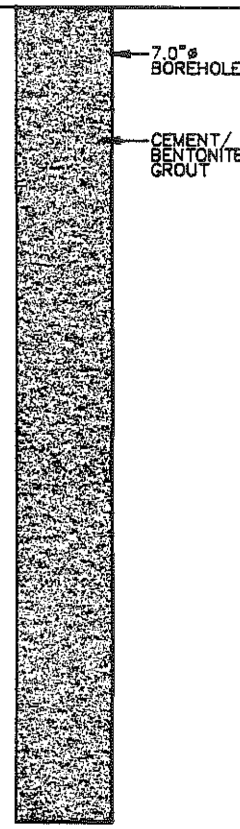
PROJECT NO.: 2616
DATE COMPLETED: DECEMBER 8, 1988

CLIENT: DETREX CORPORATION
DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete	-0.5				
1.0	CL(FILL)CLAY, some silt, little sand, trace gravel, firm, low plastic, brown, moist, odorless					
			1SS		7	10
2.0						
3.0						
	Soft, very moist, small gravel and sand pockets		2SS		5	6
4.0						
	Same, except with native CL at 5.3'					
5.0		-5.3				
	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, medium, plastic, brown, moist, odorless		3SS		12	8
6.0						
7.0						
			4SS		17	6
8.0		-8.5				
9.0	END OF HOLE @ 8.5 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.					
10.0						
11.0						
12.0						
13.0						

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

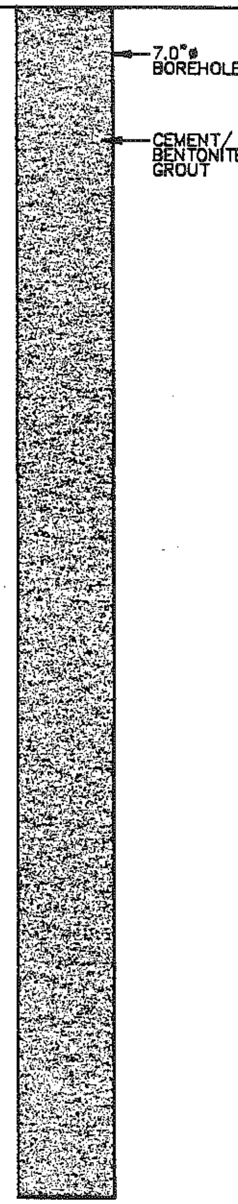
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH8-88
DATE COMPLETED: DECEMBER 7, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL
0.0	Concrete	
	SM&SW(FILL)SAND, some silt, some gravel, poor and well graded, dense, brown, odorless, moist	-0.4
	CL(FILL)CLAY, some sand, some gravel, some silt, stiff, low plastic, brown and black, odorless, moist	-3.2
7.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, brown, moist, odorless	-7.0
	SW(SAND) some gravel, dense, well graded, medium to coarse grained, massive, brown, moist, odorless	-10.2
	END OF HOLE @ 12.4 FT. BGS	-12.4

MONITOR INSTALLATION



SAMPLE

NUMBER	STATE	'N' VALUE	HNu*
1SS	X	20	6
2SS	X	11	4
3SS	X	13	4
4SS	X	15	5
5SS	X	11	4
6SS	X	39	8

NOTES: 1. Hole dry upon completion.
2. HNu readings (in PPM) taken on headspace of sample in glass jar.

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS | HOLE DESIGNATION: BH9-88

PROJECT NO.: 2616 | DATE COMPLETED: DECEMBER 6, 1988

CLIENT: DETREX CORPORATION | DRILLING METHOD: 3" SS AND JACK HAMMER

LOCATION: AS PER PLAN | CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNU
	Concrete floor slab	-0.4	7.0"ø BOREHOLE				
1.0	CL(TILL)CLAY, some silt, little sand, trace gravel, very hard, low plastic, oxide brown, moist, vertical and horizontal fissures with some secondary mineralization, no solvent odor		CEMENT/ BENTONITE GROUT	1SS			5
2.0							
3.0	Same, except with occasional silt partings, remoulded till, oxidized, extremely hard			2SS			5
4.0		-4.5					
5.0	END OF HOLE @ 4.5 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS — HOLE DESIGNATION: BH10-88

PROJECT NO.: 2616 — DATE COMPLETED: DECEMBER 6, 1988

CLIENT: DETREX CORPORATION — DRILLING METHOD: 3" SS AND JACK HAMMER

LOCATION: AS PER PLAN — CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete slab	-0.4	7.0"ø BOREHOLE; CEMENT/ BENTONITE GROUT				
1.0–2.0	ML-CL(FILL)SILT&CLAY, some sand, little gravel, firm, inclusions of ash, wood, coal, sand seam from 16" to 20", clay seam 20" to 26", peaty material approx. 19" to 20", sand (fill) again at 20" to 28"	-2.5		1SS	X		<5
3.0	OL SILT, some clay, little sand, stiff, brown-black, earthy odor	-3.9		2SS	X		<5
4.0	ML(SILT)TILL, some sand, trace clay, stiff, mottled, gray-brown, moist, rootlets, odorless	-4.3					
5.0–6.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, mottled gray-brown, moist, odorless	-6.5		3SS	X		<5
7.0	END OF HOLE @ 6.5 FT. BGS						
	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS — HOLE DESIGNATION: BH11-88

PROJECT NO.: 2616 — DATE COMPLETED: DECEMBER 6, 1988

CLIENT: DETREX CORPORATION — DRILLING METHOD: 3" SS AND JACK HAMMER

LOCATION: AS PER PLAN — CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete floor slab	-0.3	7.0"ø BOREHOLE				
1.0	CL(FILL)CLAY, and silt, some sand, little gravel, soft, low plastic, brown inclusions of earthy soil, wet, solvent odor	-0.8	CEMENT/ BENTONITE GROUT	1SS			<5
2.0	SM-ML(FILL)SAND&SILT, some clay, little gravel, poorly graded, compact, very moist, inclusions of wood, cinders, bricks, slight solvent odor						
3.0	CL(CLAY) some silt, firm, low plastic, nuggetty, mottled gray-brown, very moist, occasional pebble to 1 1/2" dia.	-3.1		2SS			<5
4.0		-4.3					
5.0	END OF HOLE @ 4.3 FT. BGS NOTES: 1. HNu readings (in PPM) taken on headspace of sample in glass jar.						
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH12-88
DATE COMPLETED: DECEMBER 8, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE HNu*
	Concrete						
	CL(FILL)CLAY, some silt, some sand, little gravel, firm, low plastic, wood chips, gravelly sand seams, odorless, moist	-0.3	7.0"ø BOREHOLE				
1.0							
	SM(FILL)SAND, some silt, some gravel, compact, black, moist, inclusions of wood, steel, coal and ashes, odorless	-1.2	CEMENT/ BENTONITE GROUT	1SS		9	20
2.0							
3.0							
				2SS		8	15
4.0							
5.0							
				3SS		4	10
6.0							
7.0							
	Sand and gravel fill, brown-black, odorless			4SS		7	6
8.0	CL(TILL)CLAY, and silt, little sand, trace gravel, stiff, low plastic, brown, moist, odorless, pebbles to 1/2" dia.	-7.8					
9.0							
				5SS		12	6
10.0							
	END OF HOLE @ 10.3 FT. BGS	-10.3					
11.0	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS

PROJECT NO.: 2616

CLIENT: DETREX CORPORATION

LOCATION: AS PER PLAN

HOLE DESIGNATION: BH13-88

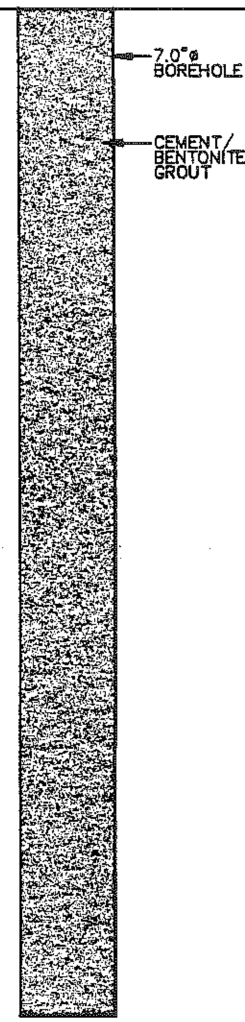
DATE COMPLETED: DECEMBER 8, 1988

DRILLING METHOD: 3 1/4" ID HSA

CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete, slight petroleum odor after penetrating concrete with augers	-0.5				
1.0	SW(FILL)SAND, some silt, some gravel, dense, well graded, black, moist, odorless, bricks, glass, wood inclusions		1SS	X	14	45
2.0						
3.0			2SS	X	15	10
4.0	CL(FILL)CLAY, some silt, little sand, some gravel, stiff, low plastic, brown, moist, coal inclusions, petroleum odor	-3.7				
5.0	SW(FILL)SAND&GRAVEL, some silt, compact, well graded, black and brown, coal inclusions, moist, odorless	-4.5	3SS	X	10	
6.0	CL(TILL)CLAY, some silt, little sand, firm, low plastic, brown, moist, odorless	-5.7				
7.0	ML&CL(layered) from 7.5' to 9.0', not continuous through that depth		4SS	X	7	8
8.0						
9.0			5SS	X	8	6
10.0						
11.0	END OF HOLE @ 10.5 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.	-10.5				
12.0						
13.0						

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

APPENDIX A

WORK PLAN
SITE INVESTIGATION

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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1.0 INTRODUCTION

1.1 SCOPE

Gold Shield Solvents, a division of Detrex Corporation, operates a storage facility in Grand Rapids, Michigan for the storage of virgin solvents and solvent destined for recycling at other Gold Shield facilities. During an excavation on an adjacent property owned by Mid-Michigan Services, trichloroethylene and other halogenated volatile organic compounds were found in soil samples collected from within the excavation.

Based on these findings, the Michigan Department of Natural Resources (MDNR) notified Detrex on July 25, 1988 that it was the MDNR's position that their Gold Shield Solvents facility was responsible for the contaminants found within the excavation. The MDNR identified this contamination to be a violation of Act 245, P.A. of 1929, as amended. A copy of the MDNR's letter of notification is presented within Appendix A.

The MDNR required that Detrex develop a work plan outlining how the extent of the area of contamination adjacent to their facility will be defined and remediated. This work plan is to also include an implementation schedule.

The following report presents Detrex's proposed Work Plan for a site investigation at the Gold Shield Solvents facility in Grand Rapids, Michigan. The Work Plan is designed to provide a determination of the impact of past Site activities on the overburden soil. This determination is required in order to properly assess the need for remediation, if any, at the Site. Figure 1 presents a Site plan showing the property boundary and the building layout.

1.2 SITE HISTORY

1.2.1 Material Handling

Detrex's Gold Shield Solvents Division sells virgin solvents as well as recycles waste solvent for resale. The Grand Rapids facility is used as a warehouse and transfer facility for the virgin product and waste solvent storage. The solvent recycling process is not carried out at this facility.

Virgin product is stored in aboveground bulk tanks which are located outside within a concrete dyked area. Waste solvents are stored in 55 gallon drums inside the building. In the past, bulk loads of virgin solvent were

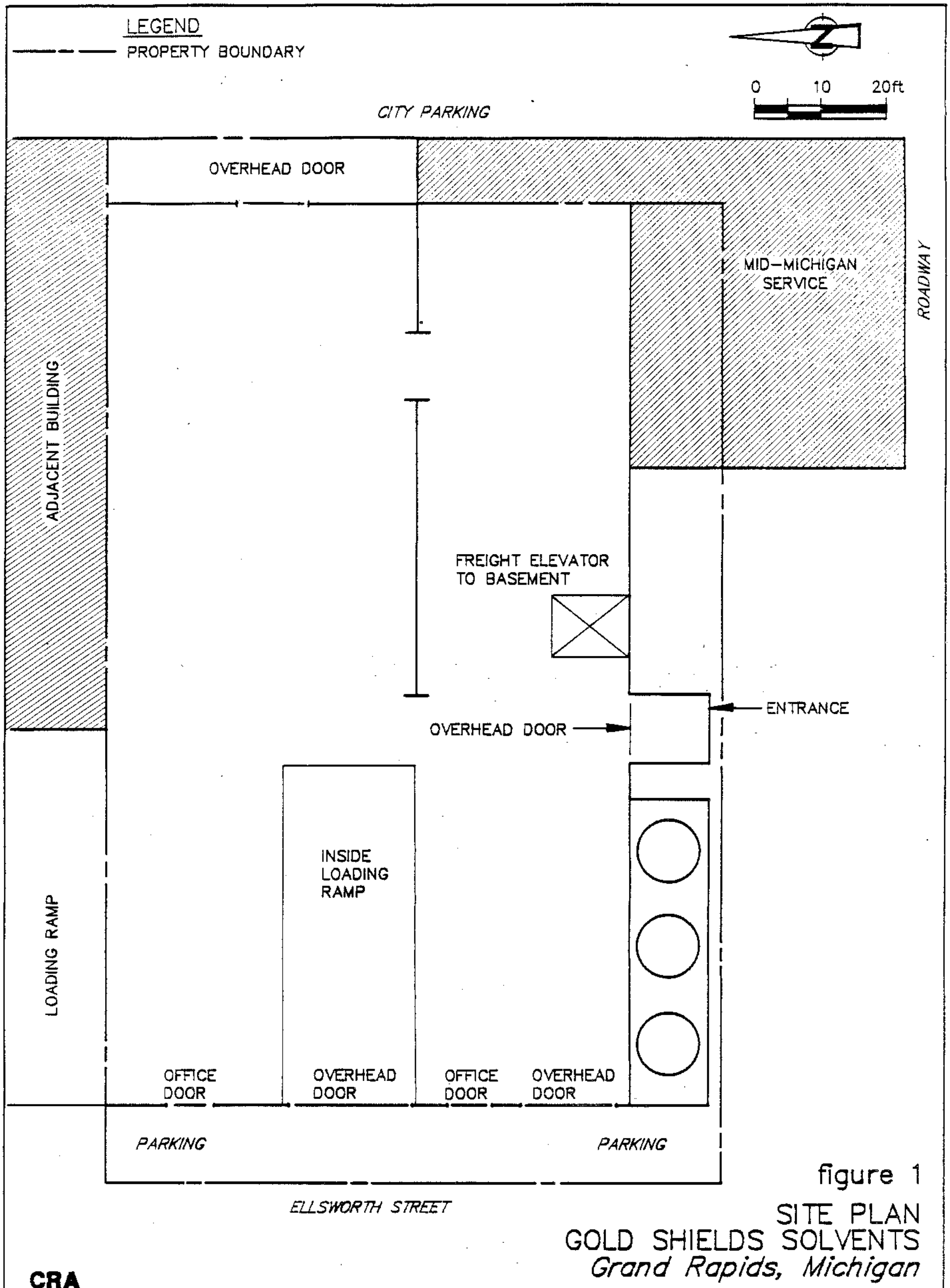


figure 1

SITE PLAN
GOLD SHIELDS SOLVENTS
Grand Rapids, Michigan

2616-16/09/88-1-F-0 (M-1)

shipped to the facility by rail in tanker cars. The transfer of this material from the tanker cars occurred along the east property boundary.

1.2.2 Site Geology

A summary of the geologic conditions at the Site has been developed through previous investigative work completed at the Site by EDI Engineering & Science. The Site and surrounding area occupies a broad area of glacial materials comprised of primarily sand and gravel interspersed with clay beds. Soil borings completed to date at the Site have encountered five to eight feet of fill material underlain by four to eight feet of silty clay. The silty clay material is underlain by three to five feet of fine grained sand. A course sand and gravel has been identified at approximately 17 feet below the ground surface down to as much as 25 feet. Groundwater has not been identified at 25 feet below the ground surface.

The lower clay unit, described as silty to sandy, soft, mottled tan to gray to yellow-brown, appears to be continuous beneath the Site. Samples collected within this clay have been found to have hydraulic conductivity values of between 1.3×10^{-8} cm/sec and 2.5×10^{-8} cm/sec. It is believed that these clays, with the low hydraulic conductivities, will retard the vertical movement of contaminants from the overburden material through the lower clay unit.

1.2.3 Past Remedial Actions

During a routine Site inspection by representatives of the MDNR in November 1985, an area along the east side of the Grand Rapids facility was identified to have potential surface contamination caused by past Site operations. In order to address this discovery by the MDNR, Detrex developed a Work Plan for an investigation of the area. This work plan was prepared by EDI Engineering & Science and was submitted to the MDNR on January 13, 1986 in the report entitled "Work Plan for a Soils Contamination Investigation - Gold Shield Solvents - Grand Rapids, Michigan".

The Work Plan was approved by the MDNR on April 15, 1986 and EDI implemented the Work Plan in April 1986. EDI presented the results of their investigation in the report entitled "Results of Investigation of Soil Quality - Gold Shield Solvents, Division of Detrex Chemical Industries - Grand Rapids, Michigan".

Based on the results of this investigation, Detrex remediated the area east of the building. Work carried out as part of the remediation included the excavation of soil identified to have elevated levels of halogenated volatile organic compounds and the disposal of the excavated soil at Wayne Disposal in Dearborn, Michigan. A total of 312 cubic yards of soil were excavated and disposed of at Wayne Disposal. This work was completed in November 1986.

Upon completing the excavation of soil, a number of confirmatory soil samples were collected and analyzed for halogenated volatile organics. Based on the remedial efforts completed by Detrex and on the confirmatory sampling completed, the MDNR approved the remediation of the east area. Therefore, the overburden soil to the area east of the building will not be addressed under the Work Plan presented herein.

2.0 OBJECTIVES

The objective of the Work Plan is to investigate the extent and degree of soil contamination resulting from past volatile organic chemical storage and handling activities at the Grand Rapids Site.

This objective will be accomplished by the installation of eleven boreholes around and adjacent to the Site and beneath the building. The purpose of these installations are as follows:

i) to characterize the surficial geology of the Site;

ii) to determine the presence and extent of any surficial confining beds;

iii) to obtain soil samples in areas of past material handling on the property for chemical analysis to identify potential source areas of contamination.

3.0 FIELD INVESTIGATIONS/PROTOCOLS

3.1 EXPLORATION SOIL BORINGS

Exploration soil borings will be collected at 11 locations adjacent to and beneath the Grand Rapids building. Six soil borings will be drilled in areas of past material handling to delineate potential source areas on Site. In addition, three soil borings will be drilled through the building floor to confirm that the lower clay unit has not been penetrated beneath the building and to determine whether a contaminant source is present beneath the building.

At each sampling location, the borehole will be extended down to the top of the lower clay unit. Split spoon samples will be collected at two foot intervals starting at the ground surface with the last sample collected from within the lower clay unit. The split spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer, free-falling 30 inches. The driving resistance (number of hammer blows) will be recorded for each six inch increment of penetration. If the soil is loose, wet, or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between each sampling the split spoon will be cleaned as described in Section 3.3. The collection and preparation of the soil samples are described in detail in Section 4.1 of this report.

Soil samples collected from the split spoon will be described and classified according to the Unified Soil Classification System and then stored in glass jars for geologic record. All samples retained for geologic record will be stored on Site. During sampling, HNu readings will be taken and recorded as each split spoon is opened, as an indication of volatile organic contamination.

Following completion, each borehole will be backfilled to the ground surface with cement/bentonite grout.

Figure 2 shows the proposed soil sampling locations.

3.2 WASTE HANDLING

All soil cuttings brought to the surface will be collected in 55 gallon DOT approved drums and transferred to a designated on-Site interim staging area. Any borehole fluid will also be contained and collected.

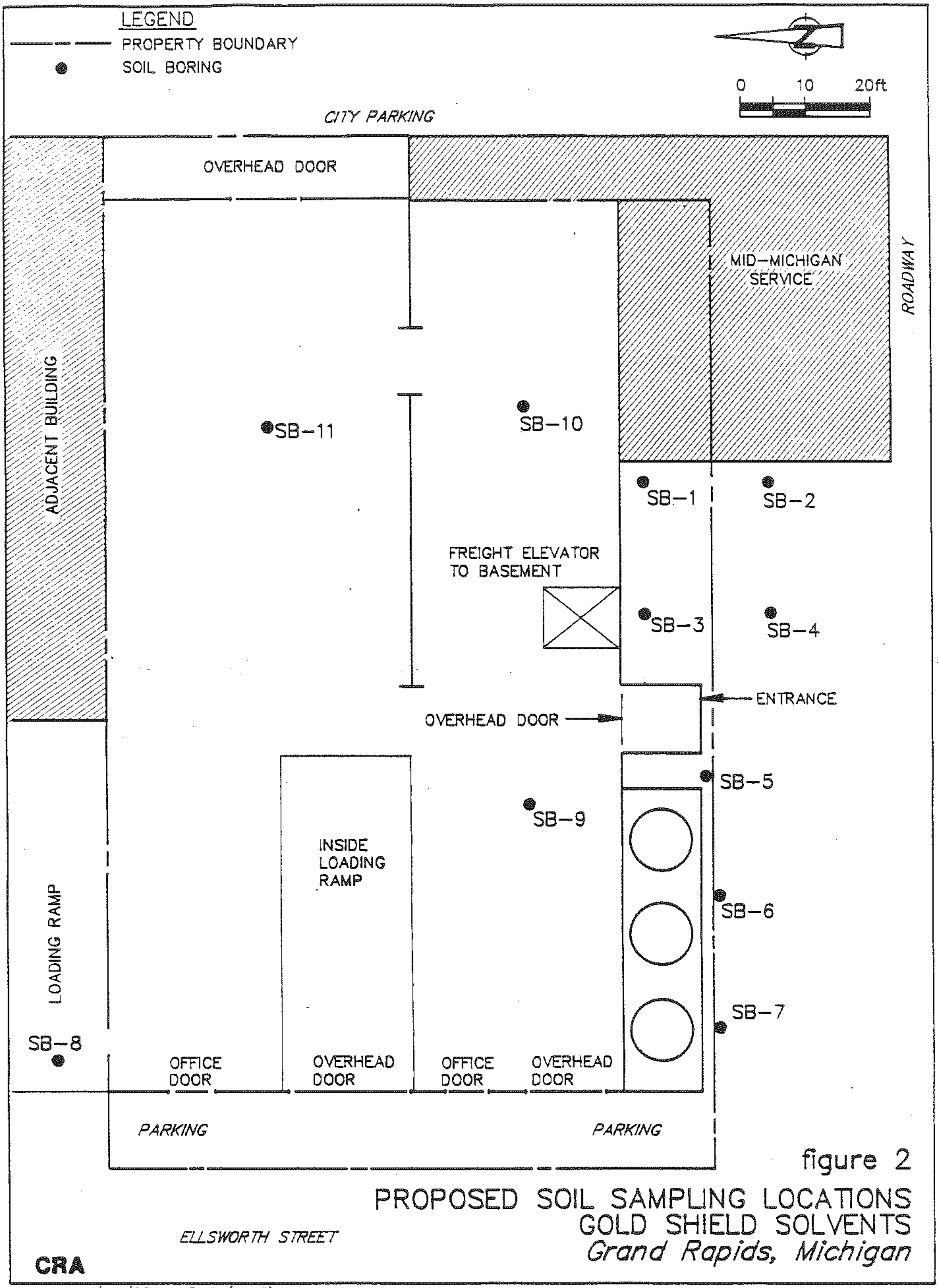


figure 2

PROPOSED SOIL SAMPLING LOCATIONS
GOLD SHIELD SOLVENTS
Grand Rapids, Michigan

2616-16/09/88-1-F-0 (M-3)

All tyveks, gloves, etc. will be collected daily in plastic bags which will be stored in the designated interim staging area.

At the completion of the field program, all waste material will be tested, analyzed and disposed of in accordance with State and Federal regulations.

3.3 EQUIPMENT CLEANING

Prior to mobilization of the drill rig, the rig and all associated equipment will be thoroughly steam cleaned to remove oil, grease, mud and other foreign matter. Subsequently, before initiating drilling at each borehole the augers, cutting bits, samplers, drill steel, and associated equipment will be cleaned to prevent cross-contamination from the previous drilling location. All cleaning will be conducted at a central area. Cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure steam wash and rinsing. Special attention will be given to the threaded sections of the drill rods and split spoons. The split spoon will be further cleaned by a isopropanol/deionized water rinse.

Following the final rinse, openings will be visually inspected to verify they are free of soil particulates and other solid material which may contribute to possible sample cross-contamination.

Equipment will be protected from all forms of solvent contact between final rinse and actual use at the sample site. All solvent rinse liquids will be segregated from wash water and disposed of in accordance with State and Federal regulations.

4.0 SAMPLING AND ANALYSIS PLAN

4.1 SOIL SAMPLING

Soil samples will be collected for chemical analyses as drilling progresses. Table 1 summarizes the number of soil samples to be taken. The sample from each split spoon will be prepared as follows:

a) The split spoon will be removed to a sample preparation station and opened.

b) Using a clean cutting tool (stainless steel knife) a thin section will be removed from the top and bottom of the core, and discarded, as shown in Figure 3.

c) The remainder of the core will then be cut longitudinally with a clean cutting tool. From the center of the core a continuous soil sample will be taken using a clean spatula. The sample will be placed into a 250-mL glass jar with teflon lid liner.

d) The remainder of the core not used for analysis will be retained in precleaned glass jars for geologic records.

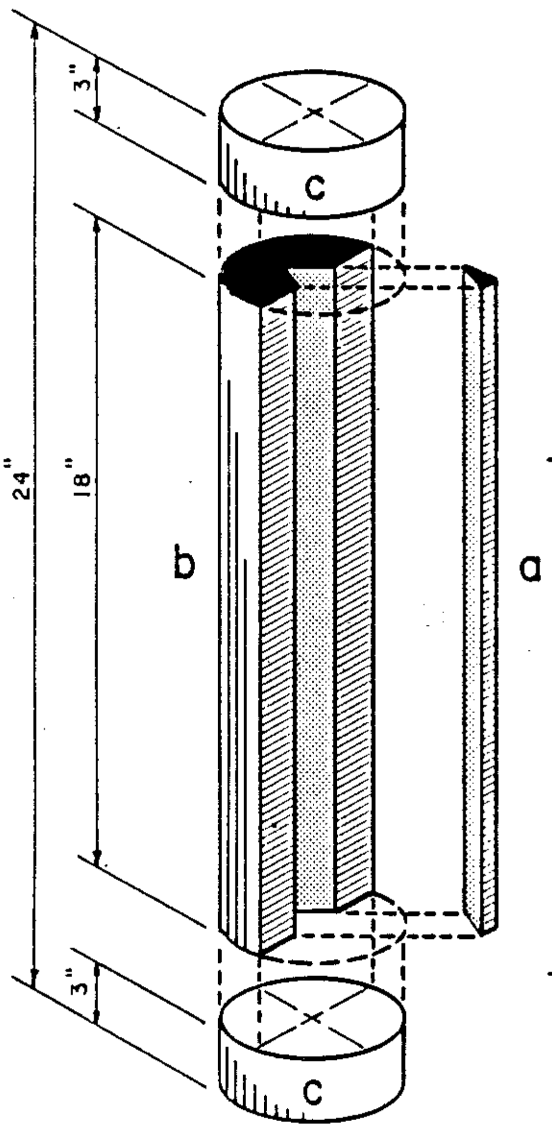
A clean pair of disposable surgical latex gloves will be used to handle each sample. Each pair of

TABLE 1

SUMMARY OF FIELD SAMPLES
GOLD SHIELD SOLVENTS
GRAND RAPIDS, MICHIGAN

	Soils
Number of samples	33*
Blind duplicates	4
Field blank	4
Matrix spike	4
Total	45

* Number of soil samples will vary with position of lower clay unit. Number presented assumes a 6 foot depth to the top of the lower clay unit.



TYPICAL SOIL CORE

a

PORTION OF SAMPLE FOR CHEMICAL ANALYSIS

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT ACCEPTABLE
- CONTAINER : PRECLEANSED 100ml. AMBER GLASS
- GASKET - TEFLON
- STORAGE - REFRIGERATED (4°C)
- SHIPPING - ON ICE BY COURIER TO DESIGNATED LAB

b

PORTION OF SAMPLE TO BE RETAINED FOR GEOLOGIC RECORDS

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT A PROBLEM
- CONTAINER : - CLEAN GLASS JAR
- CLEAR GLASS IS SUITABLE
- GASKET - ANY SUITABLE GASKET
- STORAGE - IN STANDARD SHIPPING CARTON
- NO REFRIGERATION REQUIRED

c

PORTION OF SAMPLE TO BE DISCARDED

- DISCARDED WITHIN 55 GALLON DRUM MAINTAINED ON-SITE

figure 3

SOIL SAMPLE SELECTION DETAI
GOLD SHIELD SOLVENTS
Grand Rapids, Michigan

CRA

2616-16/09/88-1-F-0

gloves will be used for no more than one sample. After retrieving a sample, latex gloves will be disposed of in a drum located on Site. At the end of the project, these materials will be disposed of in accordance with State and Federal regulations.

4.2 SAMPLE LABELING AND CONTROL

Sample labeling and control will be consistent with MDNR and USEPA requirements and CRA procedures. These procedures are discussed below.

4.2.1 Initial Labeling of Samples

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. A listing of the sample identification numbers with written descriptions of sample location, type, and date will be maintained by CRA's field personnel. The sample number system to be used is described as follows:

Example: W - AA-XXXX

where: W - designates sample type (W - water, S - soil, sediment)

AA - sampler initials

XXXX - sequential number starting with 0001

Quality Control samples will also be numbered with a unique location number.

One member of the sampling team will be responsible for recording the sampling activities for each day and will record in his log book the following with respect to each sample:

- Unique sample identification number
- Sampling location identification
- Date/time of sample collection
- Sampling data/remarks

4.2.2 Chain-of-Custody Records

CRA chain-of-custody records will be used to track all samples from the time of sampling to the arrival of samples at the laboratory. Three original copies of the chain-of-custody record will accompany the sample shipment to the laboratory and will be signed and retained by the receiving laboratory's sample custodian. A copy of the chain-of-custody record will be retained by the shipper. Two completed copies will be returned to CRA by the laboratory. A typical chain-of-custody form is presented in Appendix B.

4.3 ANALYTICAL PROTOCOLS

4.3.1 Scope

Samples collected for chemical analysis as described in the previous sections will be analyzed for halogenated volatile organics, TPH and BTXE. All analytical work will be completed using approved USEPA methodologies as specified in the following sections.

4.3.2 Water Sample Analysis

For all field blank samples, halogenated volatile organics will be analyzed using USEPA Method 8010 as presented in SW-846 "Test Methods for Evaluating Solid Waste". Analysis for TPH will be carried out using the analytical methodology for TPH as approved by the California Regional Water Quality Control Board as referenced in their memorandum of February 2, 1987 (CRWQCB File No. 1123.64) and presented in Appendix C. Analysis of BTXE will be completed using USEPA Method 8020 as presented in SW-846.

4.3.3 Soil Analysis

Soil samples being analyzed for halogenated volatile organics and BTXE will initially be prepared using a methanol extraction as described in EPA publication SW846, "Test Methods for Evaluating Solid Wastes", published July 1982, second edition. The ratio of soil to methanol and the aliquot size will be adjusted to meet the stated quantitation limits. The extract will be analyzed using methodologies and protocols described in Section 4.3.2. Samples for TPH analysis will be analyzed using the Modified California Method as identified in Section 4.3.2 and presented in Appendix C.

5.0 ON-SITE HEALTH AND SAFETY PLAN

The sampling plan described in Sections 3 and 4 involves the collection of soil samples at the Gold Shield Solvents facility in Grand Rapids, Michigan. During the program personnel may come in contact with materials that contain halogenated volatile organics.

During the program, provisions for health and safety will be implemented which are designed to ensure:

i) that personnel working on Site are not adversely exposed to Site contaminants;

ii) that the health and safety of the general public and the environment is not compromised by off-Site migration of contaminated materials; and

iii) compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists) regulations and guidelines.

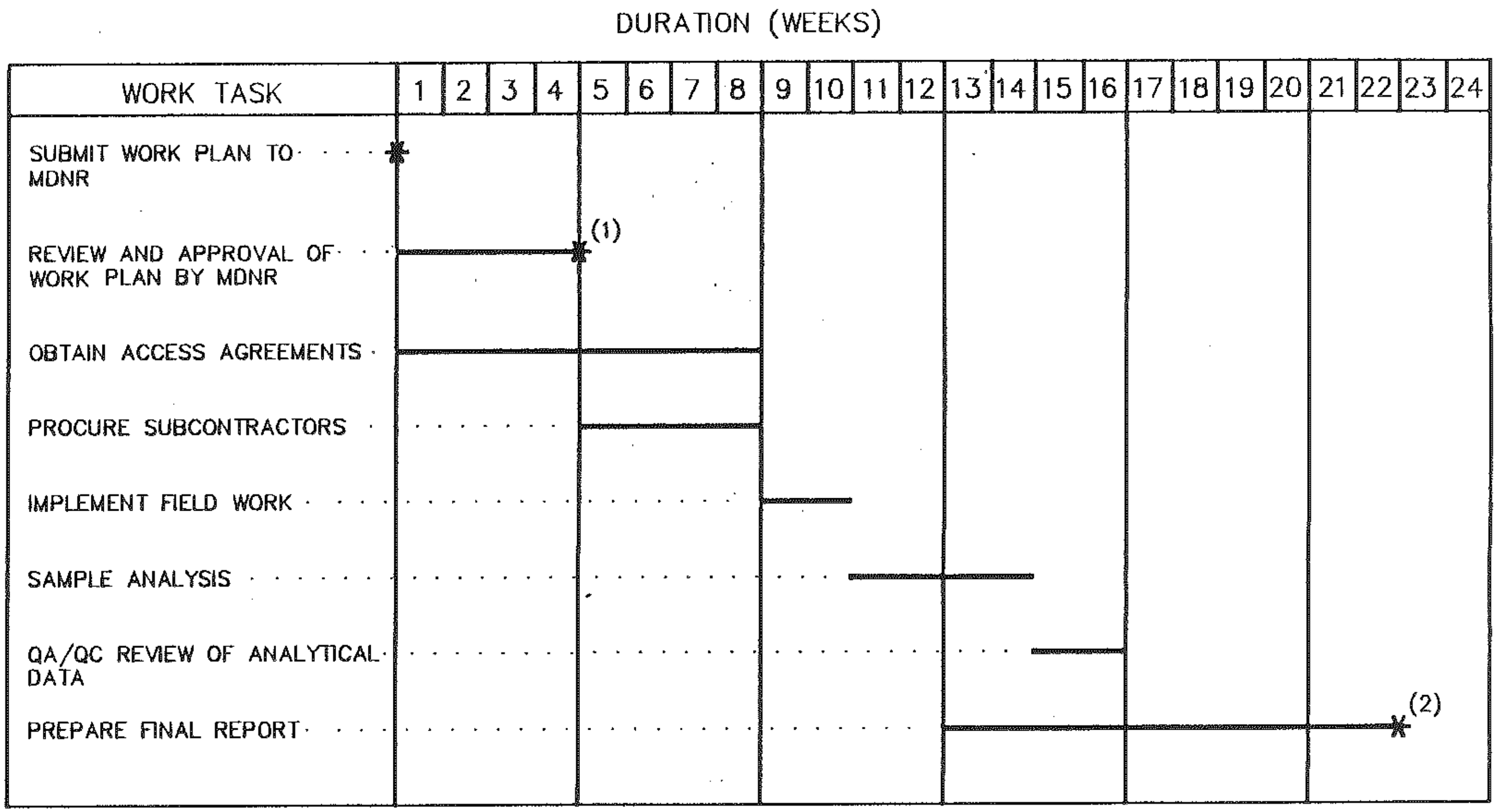
The proposed environmental Health and Safety Plan under which this work will be completed is presented in Appendix D.

6.0 IMPLEMENTATION SCHEDULE

Upon receipt of approval from the MDNR for the Work Plan presented herein, Detrex will be prepared to commence field activities within 30 days. Access agreements for the off-Site work and procurement of subcontractors will be completed during this 30 day period. It is anticipated that two weeks will be required to carry out the field investigation. Analytical data will be available for QA/QC review within 30 days of completing the field activities. Upon receipt and review of the analytical data a final report summarizing the field investigation activities and the results of the investigation will be provided to the MDNR within 45 days.

The extent of remediation at the Site, if any, can not be defined at this stage in the program. An evaluation of potential remedial action alternatives will be included as part of the final investigation report. This evaluation of potential remedial action alternatives will include implementation schedules for each alternative.

A total of 22 weeks will be required from the time that the MDNR provides approval of this Work Plan until submission of the final report. Figure 4 presents a proposed implementation schedule for this work.



NOTES:

1) MDNR APPROVAL OF WORK PLAN

2) SUBMISSION OF FINAL SITE INVESTIGATION REPORT

figure 4

PROPOSED IMPLEMENTATION SCHEDULE
GOLDSHIELD SOLVENTS
Grand Rapids, Michigan

CRA

2616-15/09/88-1-F-0 (S-1)

APPENDIX A

NOTIFICATION LETTER

I Shamiyeh
m 161AT71

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

David F. Hales, Director
State Office Building
350 Ottawa N. W.
Grand Rapids, Michigan 49503

July 26, 1988

CERTIFIED MAIL

Mr. Charles U. Guy
Detrex Chemical Industries, Inc.
Ashtabula, OH 44004

SUBJECT: Gold Shield Solvents Division, Ellsworth Avenue S. W.
Grand Rapids, Michigan (Kent County)

Dear Mr. Guy:

This letter will confirm our meeting of July 19, 1988 last week. As a result of an excavation on Mid-Michigan Service's property adjacent to the south of Gold Shield, soils with significant levels of TCE and other solvent compounds were found. In the past, soils contaminated with solvents, primarily TCE, were found and removed by Gold Shield from property adjacent to the east.

As stated in the meeting, it is our position that Gold Shield Solvents is responsible for this newly discovered area of contamination which is a violation of Act 245, P.A. of 1929, as amended. A work plan outlining how the extent of the area of contamination will be defined and remediated (including implementation schedule) should reach this office by August 26, 1988.

In addition, please provide us with the original "bench sheets" of the soils analysis results you collected from the excavation area. The retabulated information provided to us at the meeting is lacking some important information.

Please do not hesitate to call if you have any questions.

Sincerely,

JK Hoffman

Jonny K. Hoffmann
Geologist
Environmental Response Division
616 - 456-5071

JKH/mam
CC: Dale DeKraker, Waste Management Division
copy to W. Graves, Mid-Michigan Service

AUG - 2 1988

R1036-1

APPENDIX B

CHAIN-OF-CUSTODY FORM

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name):

CHAIN OF CUSTODY RECORD

PROJECT Nº:

PROJECT NAME:

SAMPLER'S SIGNATURE ______________ (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATION	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
				TOTAL NUMBER OF CONTAINERS			

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 ______ (SIGN)		2 ______ (SIGN)
2 ______ (SIGN)		3 ______ (SIGN)
3 ______ (SIGN)		4 ______ (SIGN)
4 ______ (SIGN)		5 ______ (SIGN)
5 ______ (SIGN)		6 ______ (SIGN)
6 ______ (SIGN)		7 ______ (SIGN)
7 ______ (SIGN)		8 ______ (SIGN)

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN) ______	DATE/TIME
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN) ______	DATE/TIME

WHITE — CRA OFFICE COPY
YELLOW — RECEIVING LABORATORY COPY
PINK — CRA LABORATORY COPY
GOLDENROD — SHIPPERS

APPENDIX C

LABORATORY PROCEDURE FOR ANALYZING FUEL HYDROCARBONS

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
1111 JACKSON STREET, ROOM 6040
OAKLAND 94607

Phone: Area Code 415
464-1255

February 2, 1987
File No. 1123.64 (TJC)

To: Underground Tank Program Implementing Agencies
And Certified Analytical Laboratories

Re: Laboratory Procedures For Analyzing Fuel Hydrocarbons

The purpose of this letter is to clarify the laboratory procedures to be used for analyzing fuel hydrocarbons, and to transmit a list of certified laboratories to local agencies.

The Regional Board Guidelines For Addressing Fuel Leaks (September 1985) contain descriptions of the analytical methods to be used for analyzing soil and groundwater samples polluted by gasoline, diesel, jet fuel, and waste oil. A copy of these methods is attached.

As explained in the Guidelines, the calibration for fuel analyses should be based upon an appropriate fuel standard that is representative of the suspect fuel. If available, a sample of the suspect fuel should be taken from the storage tank and sent to the laboratories to be used test calibration. If an appropriate aged fuel sample for calibration is not available, calibration may be done using a non-aged representative fuel sample.

Calibration should be established within the estimated range of contaminant levels in the sample, based on odor, sheen or pre-screening measurements (i.e., combustible gas indicator or I.R. methods). Where "non-detectable" concentrations are reported, the level of detection for total petroleum hydrocarbons shall not exceed 10 ppm for soil and 50 ppb for water.

As discussed in the Guidelines, a Chain of Custody record should be used whenever samples are taken which may be sent to a laboratory. We recommend that the words TOTAL FUEL HYDROCARBONS be written on the Chain of Custody under the section "Type of Analysis Requested". This will help the laboratories choose the most representitive calibration sample if one is not provided.

All soil and groundwater samples must be analyzed by a certified hazardous materials laboratory licensed to perform organic chemical analyses. Analyses by non-certified laboratories are unacceptable and as such do not provide compliance with Subchapter 16, HMMO, or Regional Board Guideline monitoring requirements. A list of certified laboratories is attached. Certification of laboratories is an ongoing process; additional laboratories may be currently certified but not on the list. If you have any questions concerning laboratory certification please contact Dr. Fred Seto at the Department of Health Services at (415) 540-3105.

If you have any other questions please feel free to contact me at (415) 464-0838 or Tom Callaghan at (415) 464-0787.

Sincerely,

Peter W. Johnson
Section Leader
Local Program Coordination

cc: Analytical Laboratories
Local Agencies

Enclosures: Analytical Laboratory List
Local Agency List
Analytical Methods

REVISED ANALYTICAL METHODS 11/8/85

ATTACHMENT 2

ANALYTICAL PROCEDURES FOR
THE DETECTION AND QUANTIFICATION OF TOTAL PETROLEUM
FUEL HYDROCARBONS AND FUEL CONSITUENTS

The following analytical procedures and analysis shall be used for the detection and quantification of petroleum hydrocarbons and fuel consituents. These techniques are to be followed when analysis is required for evaluation of either a suspected or confirmed tank leak as presented in the guidelines. These analytical techniques cover the full range of petroleum fuel hydrocarbons from gasoline (C_4-C_{12}) to jet fuel (C_{10}-C_{16}), to diesel (C_9-C_{22}) in either a liquid or solid matrix. Detection of complex hydrocarbon mixtures are best achieved using a Gas Chromatograph with a Flame Ionization Detector (GC/FID).

I. <u>TOTAL PETROLEUM FUEL HYDROCARBONS ANALYSIS</u>
(Low to medium boiling point hydrocarbons)
This includes the full range of gasoline. This technique may also be appropriate for military grade jet fuels.

A. <u>Sample Preparation</u>

1. <u>Water</u>

Use EPA method 5020, Headspace or EPA method 5030, Purge and Trap. (EPA manual SW-846, April 1984).

2. <u>Soil</u>

Use EPA method 5020, Headspace or EPA method 5030, Purge and Trap. (EPA manual SW-846, April 1984). Polyethylene glycol (PEG) or Methanol can be used as a extracting solvents. Extractions are applicable for the analyses of both fresh or aged fuels.

B. <u>Analysis</u>

1. Chromatographic operations for detection of total petroleum fuel hydrocarbons without BTX distinction.

Detector: Flame Ionization
Column: 10 Percent SP-2100 on 80/100 Supelcort (8ft x 1/8" glass column). Capillary columns may also be used as a substitute to improve separation.

B. Analysis (cont)

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 30mL/min.
Injector Temperature: 250°C
Detector Temperature: 300°C
Column Temperature: 40°C hold for 3 minutes, 10°C/min ramp rate to 300°C or until at least 95% of all components are eluted.

B. Analysis (cont)

2. Chromatograpic operations for detection of total petroleum fuel hydrocarbons with BTX distinction.

Detector: Photo Ionization in series with Flame Ionization.
Column: Carbopack B/3 percent SP-1500

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 10mL/min.
Injector Temperature: 200°C
Detector Temperature: 250°C
Column Temperature: 100°C x 6 min to 225°C at 10°C/min hold 25 min. or until at least 95% of all components are eluted.

C. Quantification

Quantify Total Petroleum Fuel Hydrocarbons by intergrating all major peaks within the time period in which at least 95% of the recoverable hydrocarbons are eluted. Calibration shall be based upon an appropriate fuel standard representative of the suspect fuel.

If an appropriate sample for calibration does not exist, as in the case of an aged fuel, calibration shall be done using a "non-aged" representative fuel standard.

Calibration should be established within the estimated range of contaminant levels within the sample, based on odor or sheen or on prescreening measurements (i.e., combustable gas meter, or I.R. method). Where "non-detectable concentrations" are reported, the level of detection shall not exceed 10 ppm for soil and 50 ppb for water.

II. TOTAL PETROLEUM HYDROCARBONS ANALYSIS

(High boiling point hydrocarbons)
This analysis includes the range of diesel motor fuels and commerical grade jet fuels.

A. Sample Preparation

1. Water

Use EPA method 3510, Separation, (EPA manual SW-846, April 1984). Partitioning with hexane has been found to be an acceptable preparation, however other appropriate solvents may also be used.

2. Soil

Use EPA method 3550, Sonication Extraction, (EPA manual SW-846, April 1984). Acetone extraction with sample partitioning in hexane has been found to be an acceptable sample preparation, however other appropriate solvents may also be used.

B. Analysis

Chromatographic operations for detection of total petroleum fuel hydrocarbons.

Detector: Flame Ionization
Column: 10 Percent SP-2100 on 80.100 8ft x 1/8" glass supelcoport. Capillary columns may also be used as a substitute to improve seprartion.

Typical Operating Conditions:

Carrier Gas: Nitrogen or Helium at 30mL/min.
Injector Temperature: 250°C
Detector Temperature: 300°C
Column Temperature: 40°C hold for 3 minutes, 10°C/min ramp rate to 300°C or until at least 95% of all components are eluted.

C. Quantification

Quantify Total Petroleum Fuel Hydrocarbons by intergrating all major peaks within the time period in which at least 95% of the recoverable hydrocarbons are eluted. Calibration shall be based upon an appropriate fuel standard representative of the suspect fuel.

If an appropriate sample for calibration does not exist, as in the case of an aged fuel, calibration shall be done using a "non-aged" representative fuel standard.

Calibration should be established within the estimated range of contaminant levels within the sample, based on odor or sheen or on prescreening measurements (i.e., combustable gas meter, or I.R. method). Where "non-detectable concentrations" are reported, the level of detection shall not exceed 10 ppm for soil and 50 ppb for water.

III. Quantification of Benzene, Toluene, and Xylene (BTX).

A. Sample Preparation

1. Water

Use EPA Method 602, or EPA method 5020, Headspace or method 5030, Purge and Trap, (EPA manual SW-846, April 1984).

2. Soil

Use EPA method 602 or EPA method 5020, Headspace or method 5030, Purge and Trap, (EPA manual SW-846, April 1984).

B. Analysis

Use EPA method 602 or 8020, (EPA manual SW-846, April 1984).

IV. Quantification of Ethylene Dibromide (1,2 Dibromoethane, EDB).

Use EPA method 601 or appropriate method in Recommended Methods for Analysis of Components in AB 1803, Pg. 301. (a), or any other Department Health Services analysis approved under the 1803 program.

V. Quantification of Tetraethyl Lead.

Use EPA method 7421 Atomic Adsorption/Graphite Furnace (AA/GF).

Results shall be reported as Total Lead.

a. Khalifa, Safy, Ph.D., Tamplin B.R. Ph.D., Spath, David, Ph.D., Recommended Methods Of Analysis For The Organic Components Required For AB 1803. Department of Health Services, State of California. May 1985

APPENDIX D

HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This project involves the collection and analysis of surface and subsurface soil samples. During these operations, personnel may come in contact with material that contains halogenated volatile organic compounds. The route of entry causing primary concern with these chemicals is through skin adsorption and/or inhalation. The possible ingestion of these compounds will be eliminated through proper hygienic practices.

The threshold limit values for select identified Site compounds are detailed in Table D-1.

The health and safety program has been developed on the basis of this information, and may be revised during the program as more information becomes available.

TABLE D-1

THRESHOLD LIMIT VALUES FOR SELECT COMPOUNDS

Compound	Threshold Limit Value (mg/L)
Trichloroethylene	50
1,1,1 Trichloroethane	350
Tetrachloroethylene	50

References:

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1985 - 1986.

This Health and Safety Plan has been designated to ensure:

1) that personnel working on Site are not adversely exposed to the above noted compounds;

2) that the health and safety of the general public and the environment is not compromised by off-Site migration of contaminated materials;

3) compliance with applicable governmental and non-govermental (American Conference of Govermental Industrial Hygienists) regulations and guidelines.

All Site operations will be conducted in accordance with the provisions of the Health and Safety Plan. Cost and/or scheduling considerations will not be considered as justification for modifying this plan.

For the purpose of this Health and Safety Plan "the work site" refers to the area of drilling and sampling operations delineated in the field by a controlled access. All material handling activities occurring in this area will be conducted using personal protective equipment (PPE). Similar activities occurring outside of the work site will be considered non-contaminated operations requiring a modified level of PPE. Additional detail on PPE requirements is discussed in Section 6.0.

2.0 RESPONSIBILITIES AND ADMINISTRATION

A Consultants Representative shall be designated and shall be responsible for all decisions regarding operations and work stoppage due to health and safety considerations.

The Consultants Representative's health and safety responsibilities include:

- supervision and enforcement of safety equipment usage,
- supervision and inspection of equipment cleaning,
- supervision of decontamination area,
- conduct air monitoring program, on an as-required basis,
- personnel training in safety equipment usage and emergency procedures,
- implementation of safety and health program,
- has authority to suspend work activity due to unsafe working conditions,
- informs workers of the nature of chemical exposure risk as required by Right-to-Know Law,
- responsible to recommend medical examination when worker appears to require it, and
- coordination of emergency procedures.

3.0 WORKER TRAINING AND EDUCATION

Prior to commencing site activities, a formal health and safety training program will be presented.

Attendance is mandatory for all personnel who will be or are expected to be involved with the program. Visitors and other personnel not fully trained in the health and safety aspects of this program will not be allowed to enter the immediate working zone of active drilling.

This training program will ensure that each attendee understands the basic principles of personnel protection and safety, be able to perform their assigned job tasks in a safe and environmentally responsible manner, and be prepared to respond in an appropriate manner to any emergency which may arise.

This initial training will be presented by the Consultants Representative. Follow-up sessions may be presented periodically. An outline of topics covered during each session will be developed by the presenter and distributed during the initial Site training.

4.0 RESPIRATORY PROGRAM

The United States Occupational Safety & Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, part 1910.134 (29 CFR 1910.134) will provide the basis for the respiratory program. All personnel required to wear half-mask air purifying respirators shall provide proof of a pulmonary function exam and a medical approval to wear a respirator. Additionally, each individual shall be provided with his own respirator and given a qualitative fit test with either isoamyl acetate or smoke within an enclosed tent. Those failing to pass the fit test will not be allowed to work on Site.

All personnel involved in, or observing the drilling activities, shall be required to carry, as a minimum, a half-mask respirator at all times. Air monitoring conducted as described in Section 5 will determine when respiratory protection will be required.

5.0 AIR MONITORING

An HNU Organic Vapor Photoionizer, will be used to assess background and work zone concentrations of organic hydrocarbons. Readings will be collected continuously and recorded at each 5-foot advancement into the ground, (i.e. each flight of augers).

Measurements will be taken immediately adjacent to the borehole. In the event that any significant departure from general background level is measured at the breathing zone for Site personnel, the following contingency plan will be implemented for all drilling and sampling activities:

- organic vapor >10 ppm but <50 ppm
  - don half face air purifying respirators
  - increase air monitoring in immediate work zone

- organic vapor >50 ppm
  - cease work and evacuate area
  - evaluate means to reduce organic vapor emission.

Should the organic vapor level reach 5 ppm at the Site perimeter, drilling activities will cease and the source of the vapor will either be covered, removed, wetted or capped.

The air sampling instrument will be calibrated daily and/or according to manufacturer specifications or established EPA protocols. Detailed records will be kept of calibration and sampling information.

An explosimeter will be used in conjunction with all HNU monitoring activities. If the LEL is observed to exceed 20% LEL, the HNU will be deactivated, and the area will be evacuated until remedial action is taken and determined to be effective.

6.0 SITE OPERATIONS AND ORGANIZATION

The scope of work for this project involves the drilling of eleven exploratory boreholes. All active augering in soil or sampling will require as a minimum the use of the following types of PPE:

1) Disposable, Tyvek coverall with elastic cuffs,
2) Rubber gloves with cotton liners,
3) Hardhats (liners optional),
4) Safety shoes with steel toes and shanks,
5) Rubber overboots,
6) Safety glasses with side shields, and
7) Half-mask air purifying respirators equipped with combination organic vapor, and high-efficiency particulate cartridges

The Consultants Representative shall be responsible for implementing, maintaining and enforcing the PPE program. PPE will be maintained in a clean sanitary condition and ready for use. Disposable coveralls shall be discarded when torn and as an employee leaves the Site. Respirators shall be cleaned after each day's use and cartridges discarded and replaced. A sufficient quantity of potable water shall be supplied for washing of personnel, cleaning PPE, and drinking. All sampling disposables will be disposed as deemed appropriate at the completion of the drilling program.

Additional PPE usage guidelines are as follows:

1) Prescription eyewear used on Site shall be safety glasses equipped with side shields. Contact lenses shall not be allowed on Site.

2) On Site personnel unable to pass the respirator fit testing shall not be allowed to enter or work on the Site. No facial hair is permitted on personnel who will be wearing a respirator.

3) Safety footwear and hard hats are to be worn by Site personnel at all times.

4) No watches, rings, or other accessories will be permitted during drilling/sampling activities, in accordance with general safety practices.

Site personnel also carry certain responsibilities for their own health and safety, and are required to observe the following safe work practices:

1) Familiarize themselves with the health and safety program.

2) Use the safety equipment in accordance with training received, labeling instructions and common sense.

3) Maintain safety equipment in good condition and proper working order.

4) Refrain from activities that would create additional hazards or increased opportunity for hand to mouth contact. (i.e. smoking, eating, etc. in restricted areas, leaning against dirty, potentially contaminated surfaces).

5) Soiled disposable outerwear shall be removed prior to washing hands and face, eating, using lavatory facilities, or leaving the Site.

6) All personnel involved with drilling/sampling activities will be required to wash hands, face and neck area before leaving the site at the end of the day.

7.0 DECONTAMINATION PROCEDURES

A temporary decontamination area will be established by the Consultants Representative in the field and all equipment will be cleaned in accordance with the Work Plan.

8.0 EMERGENCY AND FIRST AID EQUIPMENT AND SUPPLIES

The safety equipment listed below will be supplied for use by Site personnel and will be located in close proximity to the work zone:

1) Twenty pound ABC type dry chemical fire extinguishers. (minimum of one per drill rig)

2) First aid kit sized for a minimum of 6 people.

3) Portable eye wash.

A list of emergency response personnel (fire and police departments, ambulance, local hospital) shall be made available to the Consultants Representative and pertinent personnel. Maps of the shortest route to the selected hospital will also be made available.

APPENDIX B

FINAL REPORT

SITE INVESTIGATION

TABLE OF CONTENTS

LIST OF FIGURES

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1.0 INTRODUCTION

Gold Shield Solvents, a division of Detrex Corporation, operates a storage facility in Grand Rapids, Michigan for the storage of virgin solvents and solvent destined for recycling at other Gold Shield facilities. During an excavation on an adjacent property owned by Mid-Michigan Services, trichloroethylene and other halogenated volatile organic compounds were found in soil samples collected from within the excavation.

Based on these findings, the Michigan Department of Natural Resources (MDNR) notified Detrex on July 25, 1988 that it was the MDNR's position that their Gold Shield Solvents facility was responsible for the contaminants found within the excavation. A copy of the MDNR's letter of notification is presented within Appendix A.

The MDNR required that Detrex develop a work plan outlining how the extent of the area of contamination adjacent to their facility would be defined and remediated. This work plan was to also include an implementation schedule.

On September 26, 1988, Detrex submitted a work plan to the MDNR entitled "Work Plan - Site Investigation - Gold Shield Solvents - Grand Rapids, Michigan", Conestoga-Rovers & Associates, September 23, 1988. This document was reviewed by the MDNR, and Detrex received notice of the MDNR's approval on October 10, 1988. The sample collection, as proposed in the Work Plan, was completed during the week of December 5, 1988.

The following report presents the field observations made during the Work Plan implementation and presents the analytical data collected.

2.0 OBJECTIVES

The objective of the Site Investigation Work Plan was to investigate the extent and degree of potential soil contamination resulting from past volatile organic chemical storage and handling activities at the Grand Rapids Site. This objective was accomplished by the installation of thirteen boreholes around and adjacent to the Site and beneath the building. The purpose of these installations was as follows:

i) to characterize the surficial geology of the Site;

ii) to determine the presence and extent of any surficial confining beds; and

iii) to obtain soil samples in areas of past material handling on the property for chemical analysis to identify potential source areas of contamination.

The approved Work Plan proposed eleven soil boring locations adjacent to the Site and beneath the building. Based on field screening of the soil samples with an organic vapor analyzer (HNu), two additional soil borings were added on the south side of the building in order to attempt to define the aerial extent of soil contamination.

3.0 DESCRIPTION OF FIELD ACTIVITIES

3.1 EXPLORATION SOIL BORINGS

The firm of Sterns Drilling Inc. was retained by CRA to complete the soil borings at Detrex's Grand Rapids facility. A trailer mounted CME-45 drill rig was utilized to complete the soil borings at ten locations outside the building. A pneumatic jackhammer was used to obtain soil samples at three locations in the basement of the building. The drilling program commenced on December 6, 1988 and was completed on December 8, 1988.

Exploration soil borings were collected at thirteen locations adjacent to and beneath the Grand Rapids building. Nine soil borings were drilled in areas of past material handling to delineate potential source areas on Site. Three soil borings were drilled through the building floor to confirm that a previously identified lower clay unit has not been penetrated beneath the building and to determine whether a contaminant source is present beneath the building. A final soil boring was drilled at the northwest corner of the building in order to establish background conditions at the Site.

At each sampling location, the borehole was extended down to the top of the lower clay unit. Split spoon samples were collected at two-foot intervals starting at the ground surface with the last sample collected from within the lower clay unit. The split spoon sampler was attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer, free-falling 30 inches. The driving resistance (number of hammer blows) was recorded for each six-inch increment of penetration. Clean basket retainers were used to retain the soil in the split spoon. Between each sampling, the split spoon was cleaned as described in Section 3.2.

Soil samples collected from the split spoon were described and classified according to the Unified Soil Classification System and then stored in glass jars for geologic record. Appendix B presents the stratigraphic logs for each of the soil borings. All samples retained for geologic record have been stored on Site. During sampling, HNu readings were recorded for each split spoon as it was opened, as an indication of volatile organic contamination.

Following completion, each borehole was backfilled to the ground surface with cement/bentonite grout.

All sample preparation and handling was carried out as described in the approved Work Plan. Table 3.1 summarizes the total number of samples collected for analysis. Figure 3.1 shows the location of the thirteen soil borings completed.

3.2 EQUIPMENT CLEANING

Prior to mobilizing the drill rig, the rig and all associated equipment was thoroughly steam cleaned to remove oil, grease, mud and other foreign matter. Before initiating drilling at each borehole, the augers,

TABLE 3.1

SUMMARY OF FIELD SAMPLES
GOLD SHIELD SOLVENTS
GRAND RAPIDS, MICHIGAN

	Soils
Number of Samples	39
Blind Duplicates	4
Field Blanks (1)	4
Matrix Spikes	1
TOTAL	45

Notes:

1) Field blank consisted of deionized water poured over a split spoon following the final deionized water rinse of the decontamination protocols.

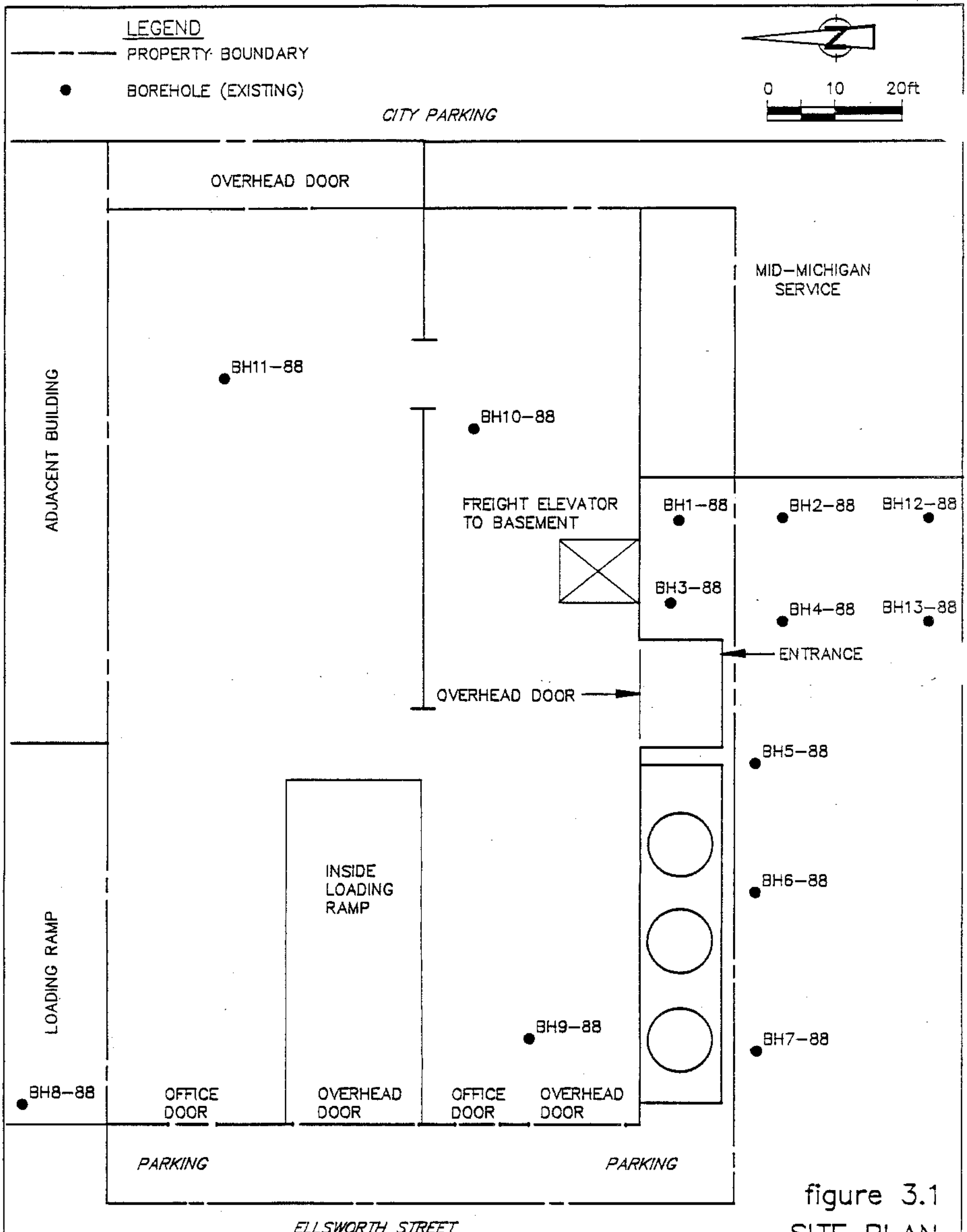


figure 3.1

SITE PLAN
GOLD SHIELDS SOLVENTS
Grand Rapids, Michigan

CRA

2616-6/03/89-2-0 (M-4)

cutting bits, samplers, drill steel and associated equipment were cleaned to prevent cross-contamination from the previous drilling location. All cleaning was conducted at a central area. Cleaning was accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure steam wash and rinsing. The split spoon samplers were further cleaned by an isopropanol/deionized water rinse after each soil sample was collected.

3.3 WASTE HANDLING

All soil cuttings brought to the surface were placed back in each borehole with a mixture of powdered bentonite clay. All soil cuttings which were not placed back into the soil boring from which they came were drummed in Federally approved DOT 55-gallon drums.

Wash water used to clean augers, samplers and all other downhole tooling was placed in DOT approved 55-gallon drums.

All disposable personal protective equipment and other Site garbage was also placed in DOT approved 55-gallon drums.

The drums were clearly labeled and placed on the shipping dock of Gold Shield Solvents pending final disposal.

4.0 FIELD OBSERVATIONS AND ANALYTICAL DATA

4.1 SITE GEOLOGY

The Site geology had previously been described by EDI Engineering & Science (EDI) based on investigative work completed by EDI at the Site in the past. A description of the Site geology was presented in the Work Plan for this Site Investigation.

The results of this most recent investigation confirm the geologic description completed by EDI, as well as expand the available information. This Site investigation confirmed the presence of a continuous layer of clay beneath the Site. The surface of this fine grained clay unit varies in depth from 5.7 feet to 8.1 feet below the ground surface. The presence of the clay unit was also confirmed beneath the building at a depth of approximately 1 to 3 feet below the basement floor. The continuity of this clay beneath the Site and the hydraulic conductivities obtained by EDI show that the clay would impede any further vertical migration of contaminants if present in the overburden soils.

The stratigraphic logs for each of the boreholes are presented in Appendix B.

4.2 ANALYTICAL DATA

4.2.1 General

All samples collected for chemical analysis were shipped under chain of custody via overnight courier (i.e. Federal Express) to Wadsworth/Alert Laboratories, Inc. (Wadsworth) of North Canton, Ohio. Samples were analyzed for volatile organic compounds (VOC's) by Wadsworth following SW846 Method 8010/8020, Third Edition. In addition, samples were analyzed for total petroleum hydrocarbons (TPH) using SW846 Method 8015 (modified).

In addition to Wadsworth's internal Quality Assurance/ Quality Control (QA/QC) procedures, CRA implemented additional QA/QC measures. These additional QA/QC measures included the collection of blind duplicate samples, rinsate blank samples and matrix spike samples.

Based on CRA's QC review of the data, the data were found to be generally acceptable with the exception of the holding times which were surpassed for many of the samples. Although the holding times were missed, the field duplicates showed good analytical precision and the matrix spike recoveries fell within the control limits established for the analytical methods. On this basis, the data is generally acceptable and can be used.

Table 4.1 presents the VOCs data for the soil samples. Table 4.2 summarizes only the positive detections for the VOCs. Table 4.3 presents the TPH data for the soil samples.

4.2.2 Data Summary

The only constituents detected in the 39 soil samples analyzed were trichloroethylene, 1,1,1-trichloroethane and TPH. Twenty of the 39 soil samples analyzed were found to have trichloroethylene present ranging from a high concentration of 920 mg/kg at BH-1 (0.6 to 2.6 feet), to a low of 1 mg/kg at BH-6 (2.5 to 4.5 feet). 1,1,1-Trichloroethane was only detected in six of the 39 samples analyzed, with a high concentration detected of 120 mg/kg at BH-3 (1.0 to 3.0 feet) and a low of 2 mg/kg at BH-7 (0.5 to 2.5 feet). Nine of the 39 soil samples analyzed were found to have TPH concentrations, with the highest concentration of 3,900 mg/kg found at BH-2 (0.4 to 2.4 feet) and the lowest of 11 mg/kg found at BH-12 (2.3 to 4.3 feet).

Of the nine soil samples collected from the three locations beneath the building, only one, BH-11 (1.0 to 2.0 feet) was found to have detectable concentrations of trichloroethylene (310 mg/kg). The remaining eight soil samples did not have any detectable concentrations of VOCs. These data show that, with the exception of an isolated area beneath the northeast corner of the building, the past Site operations have not impacted the overburden soil beneath the building.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID / *LOCATION*	*S-120788-SC-013* *BH-1 (0.6-2.6')*	*S-120788-SC-014* *BH-1 (4.6-6.6')*	*S-120788-SC-015* *BH-1 (6.6-8.6')*	*S-120788-SC-016* *BH-2 (0.4-2.4')*	*S-120788-SC-017* *BH-2 (0.4-2.4')* *(dup. of 016)*	*S-120788-SC-018* *BH-2 (4.4-6.4')*	*S-120788-SC-019* *BH-2 (7.5-8.5')*	*S-120788-SC-020* *BH-3 (1.0-3.0')*	*S-120788-SC-021* *BH-3 (5.0-7.0')*	*DETECTION LIMIT (mg/kg)*
Benzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Benzyl chloride	ND^^	ND++	ND	ND	ND°°	ND	ND	ND^	ND^	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND^^	ND++	ND	ND	ND°°	ND	ND	ND^	ND^	5
Bromobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromodichloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromoform	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Bromomethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Carbon tetrachloride	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloroform	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1-Chlorohexane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
2-Chloroethyl vinyl ether	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dibromochloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dibromomethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,3-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,4-Dichlorobenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dichlorodifluoromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1-Dichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1-Dichloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
trans-1,2-Dichloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Dichloromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,2-Dichloropropane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
trans-1,3-Dichloropropylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Ethylbenzene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,2,2-Tetrachloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,1,2-Tetrachloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Tetrachloroethylene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Toluene	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
1,1,1-Trichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	120	65	1
1,1,2-Trichloroethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Trichloroethylene	920	32	2	3	97	15	2	220	120	1
Trichlorofluoromethane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Trichloropropane	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Vinyl chloride	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1
Xylenes	ND^	ND+	ND	ND	ND°	ND	ND	ND^^^	ND^^^	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID LOCATION	S-120788-SC-022 BH-3 (7.0-9.0')	S-120788-SC-010 BH-4 (0.3-2.3')	S-120788-SC-011 BH-4 (4.3-6.3')	S-120788-SC-012 BH-4 (6.3-8.3')	S-120788-SC-023 BH-5 (1.8-3.8')	S-120788-SC-025 BH-5 (5.8-7.8')	S-120788-SC-026 BH-5 (9.0-9.8')	S-120888-SC-027 BH-6 (0.5-2.5')	S-120888-SC-028 BH-6 (2.5-4.5')	DETECTION LIMIT (mg/kg)
Benzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND++	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND++	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	ND+	ND	ND	6	ND	ND	5	4	1
1,1,2-Trichloroethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	2	20	4	ND	10	2	ND	3	1	1
Trichlorofluoromethane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND+	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
°° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID / *LOCATION*	*S-120888-SC-029* *BH-6 (8.0-8.5')*	*S-120888-SC-030* *BH-7 (0.5-2.5')*	*S-120888-SC-031* *BH-7 (2.5-4.5')*	*S-120888-SC-032* *BH-7 (4.5-6.5')*	*S-120888-SC-041* *BH-8 (0.4-2.4')*	*S-120888-SC-042* *BH-8 (4.4-6.4')*	*S-120888-SC-043* *BH-8 (6.4-8.4')*	*S-120888-SC-044* *BH-8 (10.4-12.4')*	*S-120688-SC-007* *BH-9 (0.4-1.0')*	*DETECTION LIMIT (mg/kg)*
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	2	ND	ND	ND	ND	ND	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	ND	2	ND	ND	ND	ND	ND	ND	ND	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID / *LOCATION*	*S-120688-SC-008* *BH-9 (0.4-1.0')* *(dup. of 007)*	*S-120688-SC-009* *BH-9 (4.0-4.5')*	*S-120688-SC-004* *BH-10 (0.4-1.0')*	*S-120688-SC-005* *BH-10 (1.5-2.2')*	*S-120688-SC-006* *BH-10 (2.2-2.8')*	*S-120688-SC-001* *BH-11 (0.3-1.0')*	*S-120688-SC-002* *BH-11 (1.0-2.0')*	*S-120688-SC-003* *BH-11 (3.0-3.5')*	*S-120888-SC-033* *BH-12 (0.3-2.3')*	*DETECTION LIMIT (mg/kg)*
Benzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND**	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND**	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Trichloroethylene	ND	ND	ND	ND	ND	ND	310	ND	2	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND*	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
1) °° - Detection limit = 25 mg/kg.

TABLE 4.1
ANALYTICAL DATA SUMMARY-VOCs (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID *LOCATION*	*S-120888-SC-034* *BH-12 (2.3-4.3')*	*S-120888-SC-035* *BH-12 (2.3-4.3')* *(dup. of 034)*	*S-120888-SC-036* *BH-12 (6.3-8.3')*	*S-120888-SC-037* *BH-13 (0.5-2.5')*	*S-120888-SC-038* *BH-13 (4.5-6.5')*	*S-120888-SC-039* *BH-13 (6.5-8.5')*	*S-120888-SC-040* *BH-13 (6.5-8.5')* *(dup. of 039)*	*DETECTION LIMIT (mg/kg)*
Benzene	ND	ND	ND	ND	ND	ND	ND	1
Benzyl chloride	ND	ND	ND	ND	ND	ND	ND	5
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	5
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	1
Bromoform	ND	ND	ND	ND	ND	ND	ND	1
Bromomethane	ND	ND	ND	ND	ND	ND	ND	1
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	1
Chloroacetaldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND	1
Chloroform	ND	ND	ND	ND	ND	ND	ND	1
1-Chlorohexane	ND	ND	ND	ND	ND	ND	ND	1
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	1
Chloromethane	ND	ND	ND	ND	ND	ND	ND	1
Chloromethyl methyl ether	NA	NA	NA	NA	NA	NA	NA	NA
Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	1
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	1
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	1
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	1
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	1
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	1
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	ND	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	1
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	1
Trichloroethylene	8	8	ND	25	ND	ND	ND	1
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	1
Trichloropropane	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	1
Xylenes	ND	ND	ND	ND	ND	ND	ND	1

Notes: 1) ND - Not detected above stated detection limit.
2) NA - Not Analyzed.
3) * - Detection limit = 20 mg/kg.
4) ** - Detection limit = 100 mg/kg.
5) + - Detection limit = 3 mg/kg.
6) ++ - Detection limit = 15 mg/kg.
7) ^ - Detection limit = 50 mg/kg.
8) ^^ - Detection limit = 250 mg/kg.
9) ^^^ - Detection limit = 10 mg/kg.
10) ° - Detection limit = 5 mg/kg.
11) °° - Detection limit = 25 mg/kg.

TABLE 4.2
SUMMARY OF POSITIVE DETECTIONS - VOC'S
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

LOCATION	*TRICHLOROETHYENE*	*1,1,1-TRICHLOROETHANE*
BH-1 (0.6-2.6')	920	ND(50)
BH-1 (4.6-6.6')	32	ND(3)
BH-1 (6.6-8.6')	2	ND(1)
BH-2 (0.4-2.4')	3/97	ND/ND (1)/(5)
BH-2 (4.4-6.4')	15	ND(1)
BH-2 (7.5-8.5')	2	ND(1)
BH-3 (1.0-3.0')	220	120
BH-3 (5.0-7.0')	120	65
BH-3 (7.0-9.0')	2	ND(1)
BH-4 (0.3-2.3')	20	ND(3)
BH-4 (4.3-6.3')	4	ND(1)
BH-4 (6.3-8.3')	ND(1)	ND(1)
BH-5 (1.8-3.8')	10	6
BH-5 (5.8-7.8')	2	ND(1)
BH-5 (9.0-9.8')	ND(1)	ND(1)
BH-6 (0.5-2.5')	3	5
BH-6 (2.5-4.5')	1	4
BH-6 (8.0-8.5')	ND(1)	ND(1)
BH-7 (0.5-2.5')	2	2
BH-7 (2.5-4.5')	ND(1)	ND(1)
BH-7 (4.5-6.5')	ND(1)	ND(1)
BH-8 (0.4-2.4')	ND(1)	ND(1)
BH-8 (4.4-6.4')	ND(1)	ND(1)
BH-8 (6.4-8.4')	ND(1)	ND(1)
BH-8 (10.4-12.4')	ND(1)	ND(1)
BH-9 (0.4-1.0')	ND/ND (1)/(1)	ND/ND (1)/(1)
BH-9 (4.0-4.5')	ND(1)	ND(1)
BH-10 (0.4-1.0')	ND(1)	ND(1)
BH-10 (1.5-2.2')	ND(1)	ND(1)
BH-10 (2.2-2.8')	ND(1)	ND(1)
BH-11 (0.3-1.0')	ND(1)	ND(1)
BH-11 (1.0-2.0')	310	ND(20)
BH-11 (3.0-3.5')	ND(1)	ND(1)
BH-12 (0.3-2.3')	2	ND(1)
BH-12 (2.3-4.3')	8/8	ND/ND (1)/(1)
BH-12 (6.3-8.3')	ND(1)	ND(1)
BH-13 (0.5-2.5')	25	ND(1)
BH-13 (4.5-6.5')	ND(1)	ND(1)
BH-13 (6.5-8.5')	ND/ND (1)/(1)	ND/ND (1)/(1)

Notes: 1) ND - Not detected at stated limit of detection.
2) ( ) - Number shown in brackets is detection limit.
3) 3/97 - Second number shown is duplicate analysis.

TABLE 4.3
ANALYTICAL DATA SUMMARY - TPH (mg/kg)
GOLD SHEILD SOLVENTS
GRAND RAPIDS, MICHIGAN

SAMPLE ID	LOCATION		RESULT	DETECTION LIMIT
S-120788-SC-013	BH-1 (0.6-2.6')		710	30
S-120788-SC-014	BH-1 (4.6-6.6')		660	30
S-120788-SC-015	BH-1 (6.6-8.6')		ND	10
S-120788-SC-016	BH-2 (0.4-2.4')		739	20
S-120788-SC-017	BH-2 (0.4-2.4')	(dup. of 016)	3900	40
S-120788-SC-018	BH-2 (4.4-6.4')		890	20
S-120788-SC-019	BH-2 (7.5-8.5')		ND	10
S-120788-SC-020	BH-3 (1.0-3.0')		120	20
S-120788-SC-021	BH-3 (5.0-7.0')		ND	20
S-120788-SC-022	BH-3 (7.0-9.0')		ND	10
S-120788-SC-010	BH-4 (0.3-2.3')		3000	30
S-120788-SC-011	BH-4 (4.3-6.3')		193	30
S-120788-SC-012	BH-4 (6.3-8.3')		ND	10
S-120788-SC-023	BH-5 (1.8-3.8')		ND	10
S-120788-SC-025	BH-5 (5.8-7.8')		ND	10
S-120788-SC-026	BH-5 (9.0-9.8')		ND	10
S-120888-SC-027	BH-6 (0.5-2.5')		ND	10
S-120888-SC-028	BH-6 (2.5-4.5')		ND	10
S-120888-SC-029	BH-6 (8.0-8.5')		ND	10
S-120888-SC-030	BH-7 (0.5-2.5')		ND	10
S-120888-SC-031	BH-7 (2.5-4.5')		ND	10
S-120888-SC-032	BH-7 (4.5-6.5')		ND	10
S-120888-SC-041	BH-8 (0.4-2.4')		ND	10
S-120888-SC-042	BH-8 (4.4-6.4')		ND	10
S-120888-SC-043	BH-8 (6.4-8.4')		ND	10
S-120888-SC-044	BH-8 (10.4-12.4')		ND	10
S-120688-SC-007	BH-9 (0.4-1.0')		ND	10
S-120688-SC-008	BH-9 (0.4-1.0')	(dup. of 007)	ND	10
S-120688-SC-009	BH-9 (4.0-4.5')		ND	10
S-120688-SC-004	BH-10 (0.4-1.0')		ND	10
S-120688-SC-005	BH-10 (1.5-2.2')		ND	10
S-120688-SC-006	BH-10 (2.2-2.8')		ND	10
S-120688-SC-001	BH-11 (0.3-1.0')		ND	10
S-120688-SC-002	BH-11 (1.0-2.0')		ND	10
S-120688-SC-003	BH-11 (3.0-3.5')		ND	10
S-120888-SC-033	BH-12 (0.3-2.3')		ND	10
S-120888-SC-034	BH-12 (2.3-4.3')		11	10
S-120888-SC-035	BH-12 (2.3-4.3')	(dup. of 034)	15	10
S-120888-SC-036	BH-12 (6.3-8.3')		ND	10
S-120888-SC-037	BH-13 (0.5-2.5')		38	10
S-120888-SC-038	BH-13 (4.5-6.5')		ND	10
S-120888-SC-039	BH-13 (6.5-8.5')		ND	10
S-120888-SC-040	BH-13 (6.5-8.5')	(dup. of 039)	ND	10

For the soil samples collected outside of the building, trichloroethylene and 1,1,1-trichloroethane were found at their highest concentrations at the ground surface and at the boreholes located in the southeast corner by Mid-Michigan Services. The concentrations of trichloroethylene and 1,1,1-trichloroethane were much lower in the deeper soil samples, and were detected in only three of the ten samples collected at the overburden/clay interface. The exact southerly extent of VOCs in the soil was not clearly delineated by the soil borings completed. The results of these soil analyses indicate that some spillage of VOCs may have occurred, primarily at the southeast corner of the building, with the possibility of small amounts along the aboveground tanks. However, it appears that the asphalt cover over this entire area is minimizing any surface water infiltration, thereby minimizing the vertical migration of the VOCs detected.

There were no VOCs detected in the background borehole (BH-8). This indicates that the presence of VOCs in the overburden soils is isolated to the immediate areas of past and present material handling.

The TPH found in the soil samples analyzed were isolated to the soil borings completed at the southeast corner of the building by Mid-Michigan Services. There is evidence of oil or gasoline spillage in this area. The TPH concentrations, as was the case for VOCs, are highest at the surface and decline vertically through the overburden. There were no TPH concentrations found at the overburden/clay interface. The distribution of TPH concentrations also indicates that the asphalt cover in the area is minimizing the vertical migration of the TPH.

5.0 CONCLUSIONS

Based on the sampling and analytical work completed at the Gold Shield Solvents Site in Grand Rapids, Michigan, the following conclusions are presented:

a) The Site geology described by EDI during previous investigative work was generally confirmed by this study, however, some clay or silty fill material was identified within the overburden. The overburden was comprised of an assortment of fine grained sands and some gravels.

b) A fine grained clay was identified in all of the soil borings completed. The presence of this fine grained clay in all of the borings indicates that the clay is continuous beneath the Site. The continuity of the clay and the hydraulic conductivities previously determined by EDI show that the clay would impede any further vertical migration of the contaminants detected.

c) Concentrations of trichloroethylene, 1,1,1-trichloroethane and total petroleum hydrocarbons (TPH) have been identified in overburden soils adjacent to the south side of the Gold Shield Solvents building and at one isolated location beneath the building. The concentrations of trichloroethylene, 1,1,1-trichloroethane and TPH decline vertically through the overburden to the overburden/clay interface. The asphalt cover over the areas found to be contaminated appears to be effective in minimizing the infiltration of surface water and thereby minimizing the vertical migration of contaminants.

APPENDIX A

NOTIFICATION LETTER

J. Shaughnessy
M. Tsiarty

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

David F. Hales, Director
State Office Building
350 Ottawa N. W.
Grand Rapids, Michigan 49503

July 25, 1988

CERTIFIED MAIL

Mr. Charles U. Guy
Detrex Chemical Industries, Inc.
Ashtabula, OH 44004

SUBJECT: Gold Shield Solvents Division, Ellsworth Avenue S. W.
Grand Rapids, Michigan (Kent County)

Dear Mr. Guy:

This letter will confirm our meeting of July 19, 1988 last week. As a result of an excavation on Mid-Michigan Service's property adjacent to the south of Gold Shield, soils with significant levels of TCE and other solvent compounds were found. In the past, soils contaminated with solvents, primarily TCE, were found and removed by Gold Shield from property adjacent to the east.

As stated in the meeting, it is our position that Gold Shield Solvents is responsible for this newly discovered area of contamination which is a violation of Act 245, P.A. of 1929, as amended. A work plan outlining how the extent of the area of contamination will be defined and remediated (including implementation schedule) should reach this office by August 26, 1988.

In addition, please provide us with the original "bench sheets" of the soils analysis results you collected from the excavation area. The retabulated information provided to us at the meeting is lacking some important information.

Please do not hesitate to call if you have any questions.

Sincerely,

JK Hoffmann

Jonny K. Hoffmann
Geologist
Environmental Response Division
616 - 456-5071

JKH/mam
CC: Dale DeKraker, Waste Management Division
copy to W. Graves, Mid-Michigan Service

AUG - 2 1988

R1026-1

APPENDIX B

STRATIGRAPHIC LOGS

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS

PROJECT NO.: 2616

CLIENT: DETREX CORPORATION

LOCATION: AS PER PLAN

HOLE DESIGNATION: BH1-88 (PAGE 1 of 2)

DATE COMPLETED: DECEMBER 7, 1988

DRILLING METHOD: 3 1/4" ID HSA

CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNU
	Concrete		7.0"ø BOREHOLE				
1.0	SW(FILL)SAND, some gravel, some silt, dense, well graded, clay lumps, moist, brown, strong solvent odor from surface	-0.6	CEMENT/ BENTONITE GROUT	1SS		23	440
2.0							
3.0	CL(FILL)CLAY, some silt, firm, very moist, brown, solvent odor, low plastic	-3.1		2SS		16	380
4.0							
5.0							
6.0	Slight solvent odor			3SS		4	200
7.0	CL(CLAY) some silt, little sand, trace gravel, firm, nuggetty, low plastic, mottled gray/brown, remoulded with secondary clay mineralization along horizontal and vertical fissures, moist, slight odor	-6.9		4SS		12	200
8.0							
9.0							
10.0	Brown, nuggetty, odorless			5SS		24	200
11.0							
12.0				6SS		33	180
13.0	CL(TILL)CLAY, some silt, some sand, little gravel, stiff, low plastic, brown, moist, odorless	-12.8		7SS		31	

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME:	GOLDSHIELD SOLVENTS	HOLE DESIGNATION:	BH1-88 (PAGE 2 of 2)
PROJECT NO.:	2616	DATE COMPLETED:	DECEMBER 7, 1[illegible]
CLIENT:	DETREX CORPORATION	DRILLING METHOD:	3 1/4" ID HSA
LOCATION:	AS PER PLAN	CRA SUPERVISOR:	S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	CL(TILL)CLAY, some silt, some sand, little gravel, stiff, low plastic, brown, moist, odorless		7.0"ø BOREHOLE; CEMENT/ BENTONITE GROUT	7SS	X	31	
14.0							
		-14.6					
15.0	END OF HOLE @ 14.6 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.						
16.0							
17.0							
18.0							
19.0							
20.0							
21.0							
22.0							
23.0							
24.0							
25.0							
26.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

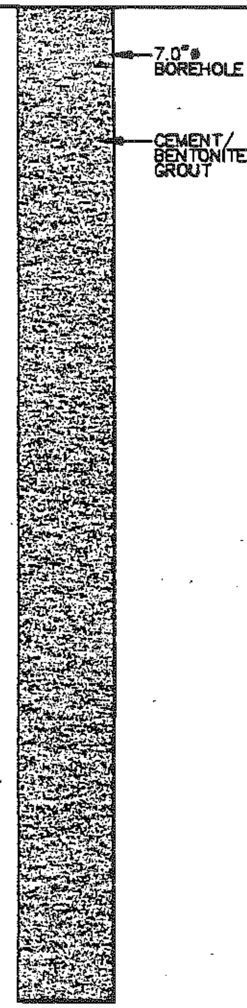
GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME:	GOLDSHIELD SOLVENTS	HOLE DESIGNATION:	BH2-88
PROJECT NO.:	2616	DATE COMPLETED:	DECEMBER 7, 1988
CLIENT:	DETREX CORPORATION	DRILLING METHOD:	3 1/4" ID HSA
LOCATION:	AS PER PLAN	CRA SUPERVISOR:	S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete					
	ML-GM(FILL) Silt, some gravel, some sand, compact, solvent odor	-0.4				
1.0			1SS		27	460
2.0						
3.0	CL fill, stiff, brown, solvent odor		2SS		21	380
4.0						
5.0	Same, except with rocks, brick, wood		3SS		34	260
6.0						
7.0	Same, except with coal seam at 7.6'		4SS		10	200
8.0	CL(CLAY)TILL, some silt, little sand, trace gravel, firm, low plastic, brown, slight solvent odor	-7.8				
9.0			5SS		11	40
10.0						
	END OF HOLE @ 10.4 FT. BGS	-10.4				
11.0	NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.					
12.0						
13.0						

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH3-88
DATE COMPLETED: DECEMBER 7, 198?
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	STATE	'N' VALUE	* HNu
	Concrete		7.0" ø BOREHOLE; CEMENT/ BENTONITE GROUT				
1.0	ML-CL(FILL) SILT&CLAY, some sand, some gravel, firm, brown and black, low plastic, inclusions of bricks, glass, bones, solvent odor	-1.0					
2.0				1SS	X	12	250
3.0							
4.0				2SS	X	5	180
5.0							
6.0	Clean fill, no inclusions, slight solvent odor			3SS	X	7	180
7.0							
8.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low to medium plastic, brown, odorless	-8.1		4SS	X	10	50
9.0							
10.0				5SS	X	12	50
11.0	END OF HOLE @ 11.0 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.	-11.0					
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS — HOLE DESIGNATION: BH4-88

PROJECT NO.: 2616 — DATE COMPLETED: DECEMBER 7, 1988

CLIENT: DETREX CORPORATION — DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN — CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	STATE	'N' VALUE	HNu*
	Asphalt	-0.3	7.0"ø BOREHOLE				
1.0	ML(FILL)SILT&CLAY, some sand, some gravel, stiff, cohesive, brown and black, moist, petroleum odor at surface		CEMENT/ BENTONITE GROUT	1SS	X	51	80
2.0							
3.0				2SS	X	15	130
4.0	Same, except with pieces of metal, coal, wood chips, not as stiff, sand seams						
5.0	Same, except with slight petroleum odor, moist			3SS	X	25	20
6.0							
7.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, mottled gray/brown, moist, occasional vertical and horizontal fissure with secondary clay mineralization, odorless	-7.1		4SS	X	16	25
8.0							
9.0	Clay mineralization, odorless			5SS	X	12	20
10.0		-10.3					
11.0	END OF HOLE @ 10.3 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu reading (in PPM) taken on headspace of sample in glass jar.						
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH5-88
DATE COMPLETED: DECEMBER 8, 198
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete, after breaking through strong solvent odor noticed		7.0"ø BOREHOLE				
1.0			CEMENT/ BENTONITE GROUT				
2.0	CL(CLAY)FILL, some silt, some sand, little gravel, firm, medium plastic, brown, strong solvent odor	-1.8					
3.0				1SS	X	8	450
4.0	Same, except with seam of cinders, sand, bricks						
5.0				2SS	X	11	480
6.0							
7.0	Same, except with slight solvent odor			3SS	X	6	180
8.0	CL(TILL)CLAY, some silt, little sand, trace gravel, firm, medium plastic, brown, moist, slight solvent odor	-7.5					
9.0				4SS	X	19	150
10.0	END OF HOLE @ 9.8 FT. BGS	-9.8					
11.0	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS — HOLE DESIGNATION: BH8-88

PROJECT NO.: 2616 — DATE COMPLETED: DECEMBER 7, 1988

CLIENT: DETREX CORPORATION — DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN — CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE * HNu
	Concrete						
1.0–3.0	SM&SW(FILL)SAND, some silt, some gravel, poor and well graded, dense, brown, odorless, moist	-0.4	7.0"ø BOREHOLE; CEMENT/ BENTONITE GROUT	1SS	X	20	6
4.0–7.0	CL(FILL)CLAY, some sand, some gravel, some silt, stiff, low plastic, brown and black, odorless, moist	-3.2		2SS	X	11	4
				3SS	X	13	4
8.0–10.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, brown, moist, odorless	-7.0		4SS	X	15	5
				5SS	X	11	4
11.0–12.0	SW(SAND) some gravel, dense, well graded, medium to coarse grained, massive, brown, moist, odorless	-10.2		6SS	X	39	8
13.0	END OF HOLE @ 12.4 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.	-12.4					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS (oval symbol) WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
HOLE DESIGNATION: BH9-88

PROJECT NO.: 2616
DATE COMPLETED: DECEMBER 6, 198?

CLIENT: DETREX CORPORATION
DRILLING METHOD: 3" SS AND JACK HAMMER

LOCATION: AS PER PLAN
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE HNu*
	Concrete floor slab						
	CL(TILL)CLAY, some silt, little sand, trace gravel, very hard, low plastic, oxide brown, moist, vertical and horizontal fissures with some secondary mineralization, no solvent odor	-0.4	7.0"ø BOREHOLE				
1.0			CEMENT/ BENTONITE GROUT	1SS			5
2.0							
3.0	Same, except with occasional silt partings, remoulded till, oxidized, extremely hard			2SS			5
4.0							
	END OF HOLE @ 4.5 FT. BGS	-4.5					
5.0	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
HOLE DESIGNATION: BH10-88
PROJECT NO.: 2616
DATE COMPLETED: DECEMBER 6, 1988
CLIENT: DETREX CORPORATION
DRILLING METHOD: 3" SS AND JACK HAMMER
LOCATION: AS PER PLAN
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE "N" VALUE	* HNu
	Concrete slab						
1.0	ML–CL(FILL)SILT&CLAY, some sand, little gravel, firm, inclusions of ash, wood, coal, sand seam from 16" to 20", clay seam 20" to 26", peaty material approx. 19" to 20", sand (fill) again at 20" to 28"	-0.4	7.0"ø BOREHOLE; CEMENT/ BENTONITE GROUT	1SS	X		<5
2.0							
3.0	OL SILT, some clay, little sand, stiff, brown–black, earthy odor	-2.5		2SS	X		<5
4.0	ML(SILT)TILL, some sand, trace clay, stiff, mottled, gray–brown, moist, rootlets, odorless	-3.9					
5.0	CL(TILL)CLAY, some silt, little sand, trace gravel, stiff, low plastic, mottled gray–brown, moist, odorless	-4.3		3SS	X		<5
6.0							
7.0	END OF HOLE @ 6.5 FT. BGS	-6.5					
8.0	NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.						
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH11-88
DATE COMPLETED: DECEMBER 6, 1988
DRILLING METHOD: 3" SS AND JACK HAMMER
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	STATE	'N' VALUE	* HNu
	Concrete floor slab	-0.3	7.0" ø BOREHOLE				
1.0	CL(FILL)CLAY, and silt, some sand, little gravel, soft, low plastic, brown inclusions of earthy soil, wet, solvent odor	-0.8	CEMENT/ BENTONITE GROUT	1SS			<5
2.0	SM-ML(FILL)SAND&SILT, some clay, little gravel, poorly graded, compact, very moist, inclusions of wood, cinders, bricks, slight solvent odor						
3.0	CL(CLAY) some silt, firm, low plastic, nuggetty, mottled gray-brown, very moist, occasional pebble to 1 1/2" dia.	-3.1		2SS			<5
4.0		-4.3					
5.0	END OF HOLE @ 4.3 FT. BGS NOTES: 1. HNu readings (in PPM) taken on headspace of sample in glass jar.						
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

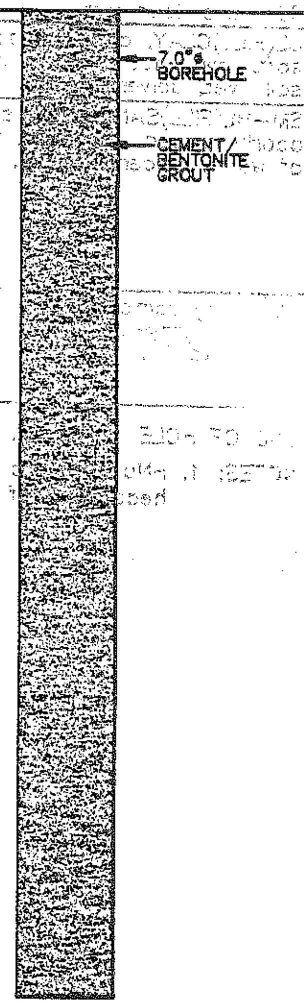
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS
PROJECT NO.: 2616
CLIENT: DETREX CORPORATION
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH12-88
DATE COMPLETED: DECEMBER 8, 1988
DRILLING METHOD: 3 1/4" ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL
	Concrete	-0.3
1.0	CL(FILL)CLAY, some silt, some sand, little gravel, firm, low plastic, wood chips, gravelly sand seams, odorless, moist	-1.2
2.0	SM(FILL)SAND, some silt, some gravel, compact, black, moist, inclusions of wood, steel, coal and ashes, odorless	
3.0		
4.0		
5.0		
6.0		
7.0	Sand and gravel fill, brown-black, odorless	-7.8
8.0	CL(TILL)CLAY, and silt, little sand, trace gravel, stiff, low plastic, brown, moist, odorless, pebbles to 1/2" dia.	
9.0		
10.0		-10.3
11.0	END OF HOLE @ 10.3 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.	
12.0		
13.0		

MONITOR INSTALLATION



SAMPLE NUMBER	STATE	'N' VALUE	* HNu
1SS		9	20
2SS		8	15
3SS		4	10
4SS		7	6
5SS		12	6

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GOLDSHIELD SOLVENTS

HOLE DESIGNATION: BH13–88

PROJECT NO.: 2616

DATE COMPLETED: DECEMBER 8, 198_

CLIENT: DETREX CORPORATION

DRILLING METHOD: 3 1/4" ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE	SAMPLE HNu
	Concrete, slight petroleum odor after penetrating concrete with augers	-0.5	7.0"ø BOREHOLE				
1.0	SW(FILL)SAND, some silt, some gravel, dense, well graded, black, moist, odorless, bricks, glass, wood inclusions		CEMENT/ BENTONITE GROUT	1SS		14	45
2.0							
3.0				2SS		15	10
4.0	CL(FILL)CLAY, some silt, little sand, some gravel, stiff, low plastic, brown, moist, coal inclusions, petroleum odor	-3.7					
5.0	SW(FILL)SAND&GRAVEL, some silt, compact, well graded, black and brown, coal inclusions, moist, odorless	-4.5		3SS		10	
6.0	CL(TILL)CLAY, some silt, little sand, firm, low plastic, brown, moist, odorless	-5.7					
7.0	ML&CL(layered) from 7.5' to 9.0', not continuous through that depth			4SS		7	8
8.0							
9.0				5SS		8	6
10.0							
11.0	END OF HOLE @ 10.5 FT. BGS NOTES: 1. Hole dry upon completion. 2. HNu readings (in PPM) taken on headspace of sample in glass jar.	-10.5					
12.0							
13.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

PLAN OF CLOSURE
HAZARDOUS WASTE STORAGE TANKS

Detrex Corporation
Gold Shield Solvents
Grand Rapids, Michigan

PLAN OF CLOSURE

HAZARDOUS WASTE STORAGE TANKS

Detrex Corporation
Gold Shield Solvents
Grand Rapids, Michigan

February 1989
Ref. No. 2471

CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

1.1 BACKGROUND

The State of Michigan, Department of Natural Resources (DNR), Waste Management Division (WMD), has requested in a letter dated November 30, 1988, addressed to Detrex Corporation (received by Detrex Corporation on December 12, 1988), that a closure plan must be submitted (apart from the Act 64 Operating License Application) for hazardous waste storage tanks at the Gold Shield Solvents', Grand Rapids facility. In response to the DNR's request, this report presents a plan of closure and cost estimate for the following hazardous waste management tanks at the Grand Rapids facility: two above ground inactive, disconnected steel tanks.

Figure 1 locates the Grand Rapids, Gold Shield Solvents' facility. Figure 2 presents a facility plan, locating the two inactive, disconnected hazardous waste tanks, designated for closure.

Gold Shield Solvents historically recovered solvents from hazardous waste streams via distillation at the Grand Rapids facility. Hazardous wastes were received at the facility in 55-gallon drums. Upon receipt, all drums were dated, sampled and transferred to the appropriate area in the hazardous waste container storage areas to await recycling. (Note: An Act 64 Operating License Application was submitted on November 8, 1988 for the hazardous waste container storage area).

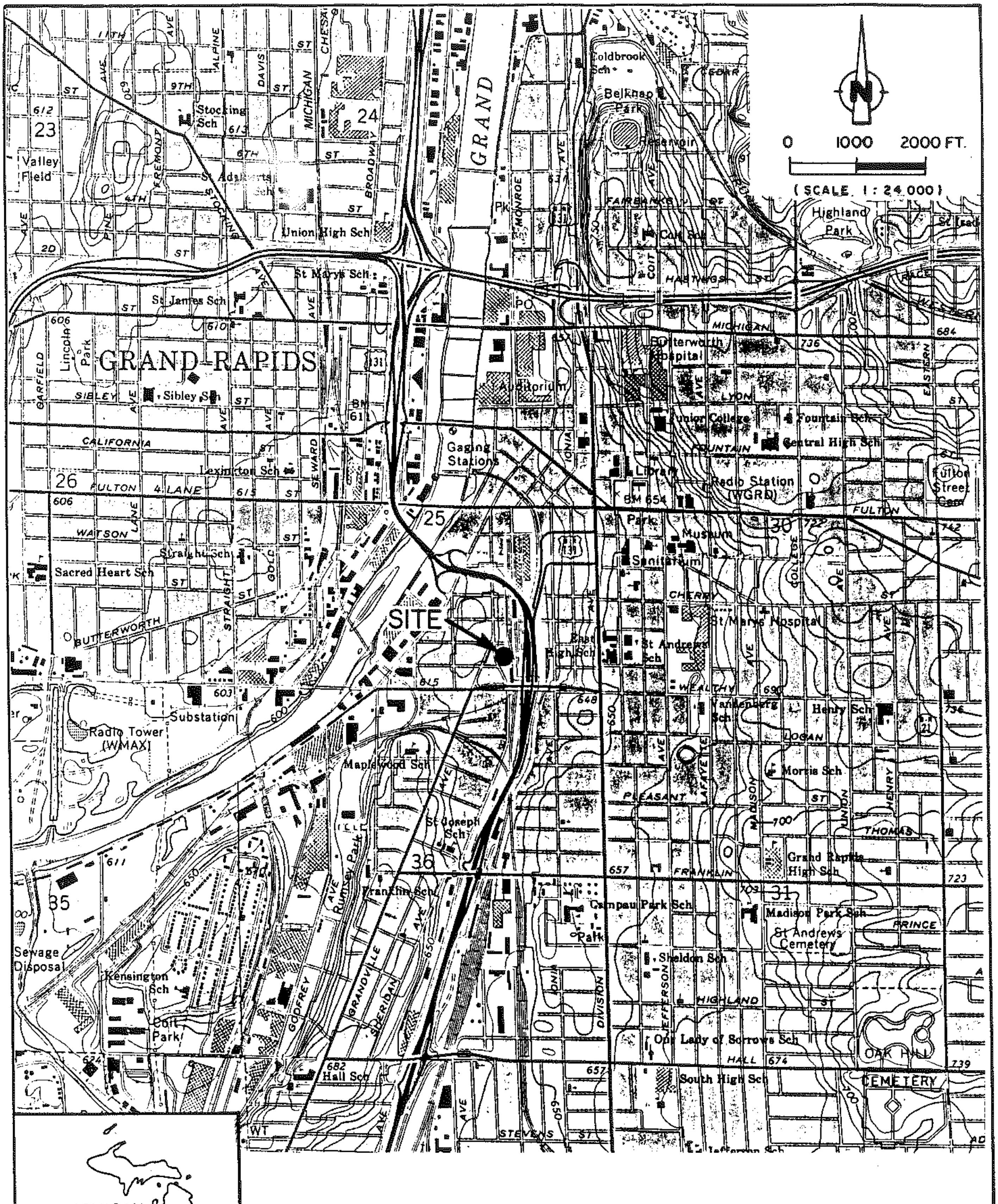


figure 1
SITE LOCATION
Detrex Corporation
Gold Shield Solvents, Grand Rapids

CRA

2471-26/01/89-7-0

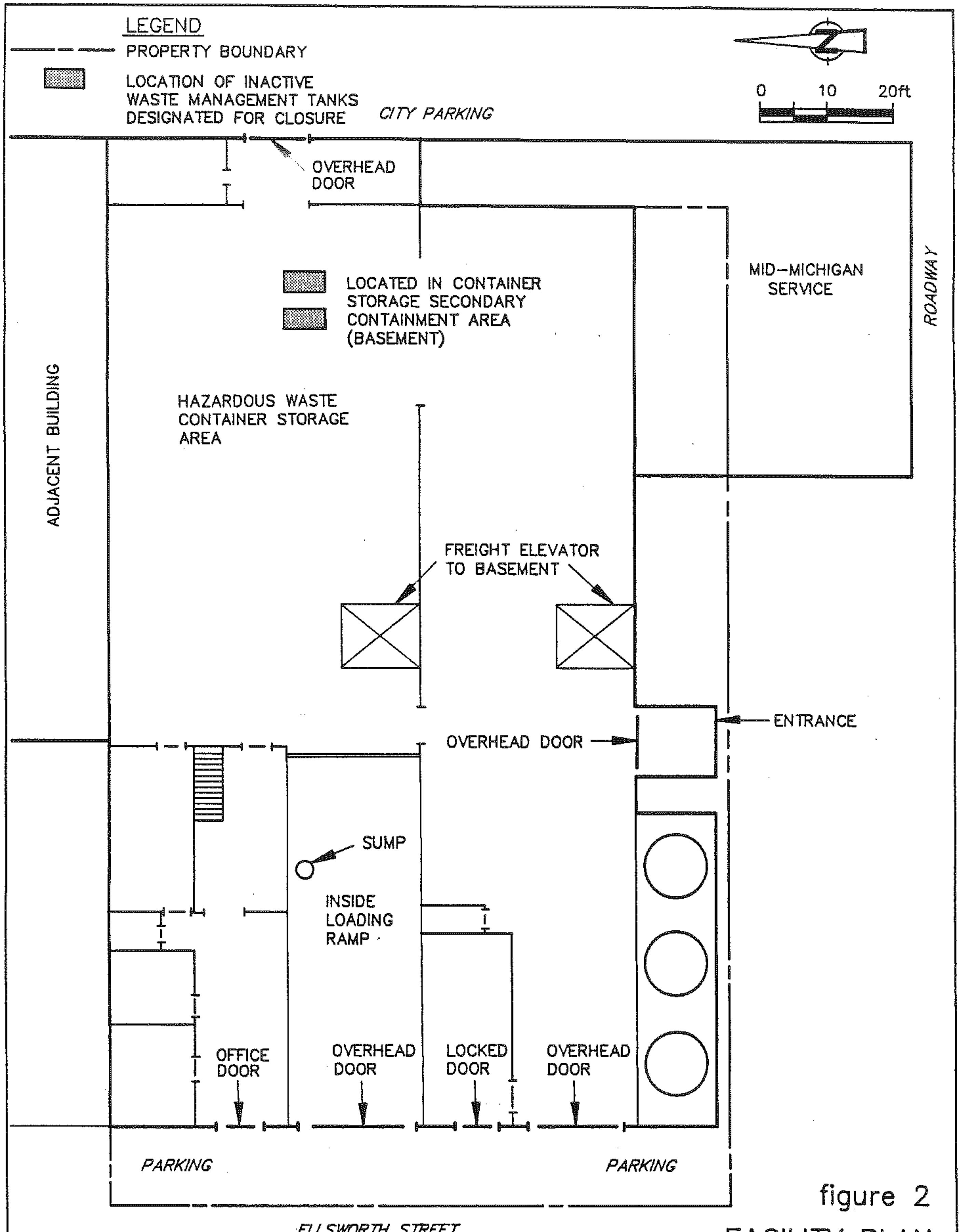


figure 2

FACILITY PLAN
Detrex Corporation
Gold Shield Solvents, Grand Rapids

CRA

2471-26/01/89-7-1

PRELIMINARY REVIEW REPORT (PR)
RCRA FACILITY ASSESSMENT (RFA)

Facility Name Detrex Gold Shield Solvents
EPA ID # MID 020 906 764
Preparer Lorna M. Jereza
Date

2. General Description of Facility and Processes:

A. Description:

B. Information on Solid Waste Management Units (attach additional sheets as needed):

Unit | Release (yes/no/unknown/suspected)

i.

ii.

iii.

iv.

v.

vi.

vii.

viii.

ix.

x.

Once the drum contents had been identified by specific gravity and/or chromatographic analysis, drums containing the same solvent (i.e. TCE) were transferred to the recycling area. The drum contents were charged individually into a batch distillation unit and the solvent content removed by heating the material with indirect stream. As the still level fell, additional waste was introduced until the still reboiler contained essentially only still bottoms. At this point, the still bottoms were heated to a pre-determined temperature to reduce the solvent content further. Subsequently, the still bottoms were transferred to accumulation tanks, located in the basement, to await final disposal off-Site.

The Gold Shield Solvents' hazardous waste recycling operation historically used generator accumulation tanks for the accumulation of still bottoms remaining at the end of the distillation process. Hazardous wastes were typically stored in these tanks for less than 90 days, prior to off-site disposal/treatment. In 1987, the tank inventories were removed, piping disconnected, and the tanks cleaned.

In 1980, 1,900 gallons of design capacity for process code-S02 (tank storage) was included on Detrex Corporation's original Part A application for the Grand Rapids Gold Shield Solvents' facility. At that time, the Gold Shield Solvents' facility utilized two generator accumulation tanks (combined capacity of approximately 1,900-gallons) and Detrex mistakenly included the tank's design capacity on the original Part A application. However, based on the previously referenced letter from the DNR, dated November 30, 1988, the WMD records indicate "...that the 'generator accumulation tanks' were included on the corporation's original Part A

application and were historically used for 'accumulation' of hazardous waste for periods in excess of 90 days. Such action qualifies the 'generator accumulation tanks' as hazardous waste storage tanks." Based on the DNR's determination that the generator accumulation tanks included on the original Part A application are hazardous waste storage tanks, Detrex Corporation will close the tanks in accordance with 40 CFR § 265, Subpart-G.

1.2 CLOSURE PLAN [40 CFR § 264.112]

The closure plan for the hazardous waste tanks, designated for closure, pursuant to the requirements of 40 CFR § 265.112-265.115, is presented in Section 2.0.

The closure plan is designed to ensure that the hazardous waste management tanks will:

1) not require further maintenance and controls; and,

2) minimize/eliminate potential threats to human health and the environment.

Upon completion of closure activities, Detrex Corporation will submit to the Director, pursuant to the requirements of 40 CFR § 265.111, a certification by both Detrex Corporation and an independent Professional Engineer, registered in the State of Michigan, that the closure has been carried out in accordance with the approved plan.

1.3 CLOSURE COST ESTIMATE [40 CFR § 265.142]

The closure cost estimate for the hazardous waste tanks, designated for closure, pursuant to the requirements of 40 CFR § 265.142, is presented in Section 3.0.

1.4 SCHEDULE OF CLOSURE [40 CFR § 265.112, § 265.113]

The schedule of closure for the hazardous waste tanks, designated for closure, pursuant to the requirements of 40 CFR § 265.112 and § 265.113, is presented in Section 4.0.

2.0 CLOSURE OF HAZARDOUS WASTE STORAGE TANKS [40 CFR § 265.111 through § 265.115]

2.1 GENERAL

The closure of the two hazardous waste storage tanks will be conducted in accordance with interim status standards 40 CFR Part 265, Subpart G.

As discussed previously, in Section 1.1, Detrex removed all tank inventory and disconnected all piping to the tanks in 1987. Detrex is proposing to decontaminate the two hazardous waste tanks under interim closure standards, and therefore, post-closure care associated with the two tanks will not be required.

The following subsections describe the location and physical characteristics of each tank and the closure procedures to be adhered to.

2.2 TANK DESCRIPTIONS

Both tanks are open top, rectangular, carbon steel tanks and have identical capacities and dimensions. The gross capacity and dimensions of each tank is 950 gallons (effective capacity of 905 gallons) and $80\frac{1}{2}$" x 39" x 70", respectively. Figure 2, shows the location of the two tanks in

the Gold Shield Solvents' facility. The tanks are located within the secondary containment system for the facility's hazardous waste container storage area.

The tanks were historically used for the accumulation of the F002 still bottom wastes listed on Table 1.

2.3 CLOSURE PROCEDURE [40 CFR § 265.112]

Closure of the two hazardous waste tanks will be carried out in accordance with the following procedures.

Any remaining sludges and tank scale, will be hand shovelled into DOT approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility.

Following removal of any remaining sludges and tank scale from each of the tanks designated for closure, Detrex will decontaminate the interior of each tank. The decontamination protocol to be followed by Detrex is summarized as follows:

a) Solvent rinse the interior of each tank with 1,1,1-Trichloroethane, and allow to air dry; and

b) Steam clean the interior of each tank and allow to air dry.

TABLE 1

HAZARDOUS WASTE SUMMARY

	EPA Hazardous Waste Number	*Hazardous Characteristic*
1,1,1 Trichloroethane	F002	Toxic
Trichloroethylene	F002	Toxic
Perchloroethylene	F002	Toxic
Methylene Chloride	F002	Toxic
Trichlorotrifluoroethane	F002	Toxic

All equipment used during tank decontamination will be steam cleaned.

All solvent rinses and wash water generated from the tank/equipment decontamination will be collected into DOT approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility. All wastes, based on Detrex's previous recycling operation, will be classified as F002 wastes.

Upon completion of the decontamination procedures of each tank and equipment, the floor area under and adjacent to each tank will be swept. All sweepings will be placed into DOT-approved 55-gallon drums for ultimate transportation off site to a permitted treatment or disposal facility.

All waste shipments will be manifested in accordance with 40 CFR Part 265, Subpart E and accompanied by notification required under 40 CFR § 268.17.

Following decontamination, the hazardous waste storage tanks, designated for closure, may be dismantled and disposed of as non-hazardous scrap. The dismantling and disposal of the tanks is, therefore, not included under the closure cost estimate or closure schedule.

2.4 CLOSURE CERTIFICATION [40 CFR § 265.115]

Following closure of the two hazardous waste tanks, Detrex Corporation will submit to the Director certification by both Detrex Corporation and an independent Professional Engineer, registered in the State of Michigan, that the tanks have been closed in accordance with the approved plan of closure.

3.0 CLOSURE COST ESTIMATE [40 CFR § 264.142]

The total closure cost for the closure of the Detrex Corporation, Gold Shield Solvents' facility two hazardous waste tanks is estimated at $9,120. (1989 dollars). Table 2 provides a closure cost estimate. Activities include removal of tank sludge and scale, decontamination and closure certification.

The cost estimate assumptions made are:

1) Labor costs are presented at $25.00 per hour to account for labor costs and $30.00 per hour for supervisors. All labor rates reflect commercial rates and include fringe benefits, payroll burden and taxes.

2) Total costs include a 15% contingency for administrative and 20% contingency for miscellaneous operating costs.

TABLE 2

CLOSURE COST ESTIMATE

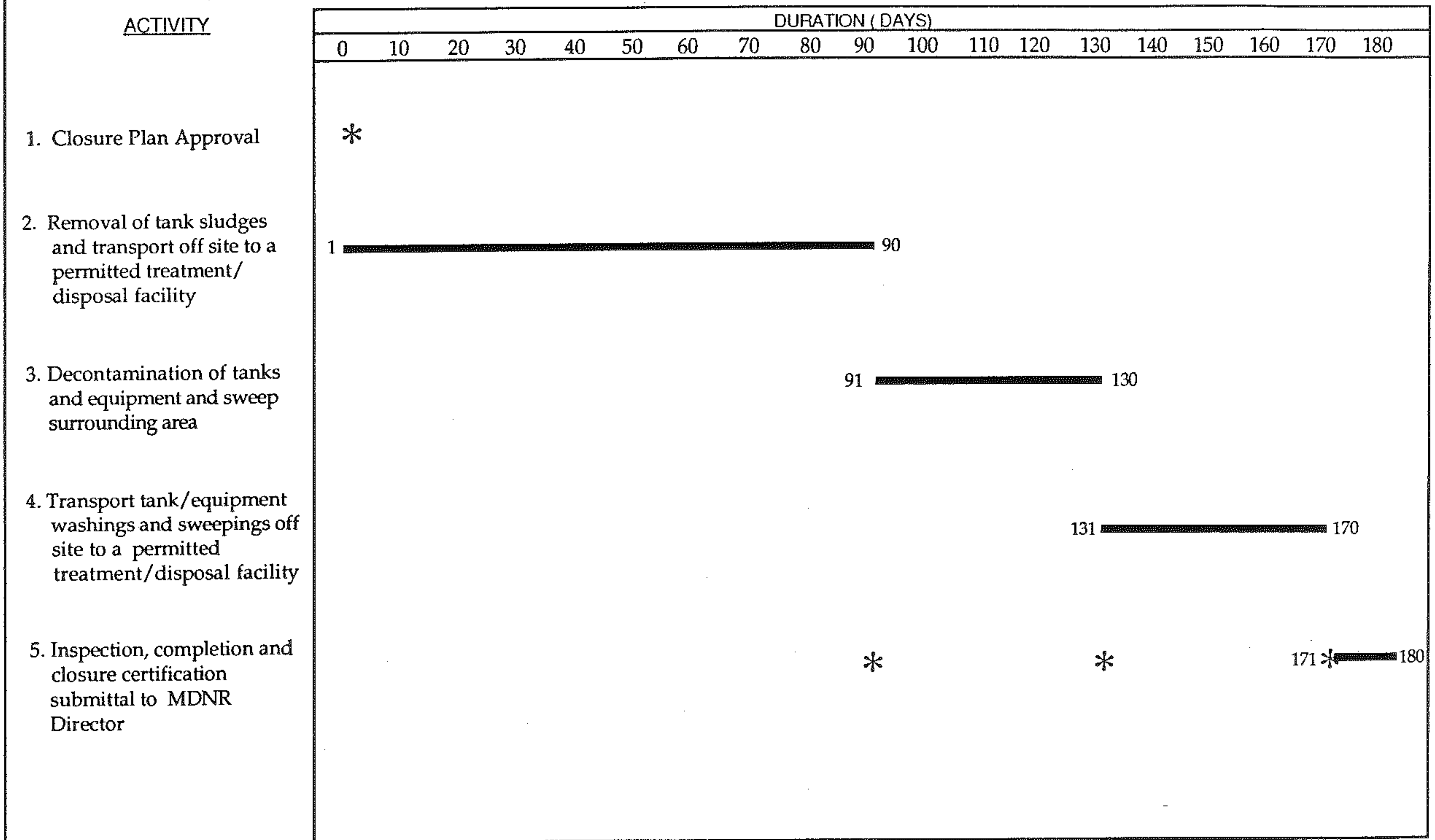
ITEM	ACTIVITY	ESTIMATED COST
1.	Remove, collect and drum tank sludge and scale	
	a) Labor: 1 man day @ $200/day	$200.00
	b) Supervision: 1/2 man day @ $240/day	120.00
	c) Equipment to move drummed waste to facility container storage area @ $400/day	200.00
	Sub-Total 1	$520.00
2.	Transport and off-site disposal of drummed tank sludges at a permitted facility @ $440/drum	$880.00
	Sub-Total 2	$880.00
3.	Decontaminate tanks and surrounding area	
	a) Labor: 2 man days @ $200/day	$400.00
	b) Supervision: 1 man day @ $240/day	240.00
	c) Equipment for decontamination and miscellaneous material handling @ $400/day	400.00
	d) Transport and off-site disposal of tank washings and sweepings at a permitted facility at $440/drum	1,320.00
	Sub-Total 3	$2,360.00
4.	Closure Certification	
	a) Profession Engineer to review final closure plans, inspect closure activities and certify closure @ $500/day	$2,000.00
	b) Disbursements including office expenses and travel expenses	1,000.00
	Sub-Total 4	$3,000.00
	Sub-Total 1, 2, 3 & 4	$6,760.00
	Administration (15%)	1,010.00
	Contingency (20%)	1,350.00
	Total Estimated Final Closure Cost	$9,120.00

Notes:
1) Waste inventory has already been removed from the tanks.
2) Sludge volume estimated @ 5% of tank volume.
3) Tank washings volume estimated @ 5% of tank volume.
4) All costs presented in 1989 dollars.

4.0 CLOSURE SCHEDULE [40 CFR § 265.112, 265.113]

Within 90 days after receipt of final approval of the closure plan, Detrex Corporation will transport off site all tank sludges, and within 180 days after receipt of final approval of the closure plan, Detrex Corporation will complete all closure activities in accordance with the approved plan.

The proposed closure schedule for tank closure activities is presented on Figure 3.



LEGEND

▬ ACTIVITY DURATION

* EVENT / INSPECTION

figure 3

PROPOSED TANK CLOSURE SCHEDULE

Detrex Corporation

Gold Shield Solvents, Grand Rapids

CRA

2471-26/01/89-7-0

All of Which is Respectfully Submitted,

CONESTOGA-ROVERS & ASSOCIATES

Ed Roberts, P. Eng.

A.4.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF:
5HE-12

MAR 26 1987

MID 091 605 972
U.S. EPA ID #: MID 020 906 764

Detrex Chemical Industris, Inc.
Post Office Box 501
Detroit, Michigan 48232

Re: RCRA Financial Responsibility

Dear Owner/Operator:

On October 30, 1986, the State of Michigan was granted final authorization by the Administrator of the United States Environmental Protection Agency (U.S. EPA) to administer a hazardous waste program in lieu of the Federal program. As a result of final authorization, Michigan is required to enforce the provisions of the Resource Conservation and Recovery Act (RCRA). One of these provisions (40 CFR Part 265, Subpart H) requires all hazardous waste facilities to demonstrate financial responsibility for liability coverage and closure/post-closure care.

To implement this aspect of authorization, financial documents must be written to satisfy the requirements of the Michigan Administrative Code 1985 AACS, Part 7, which is the Michigan equivalent of 40 CFR Part 265, Subpart H. This letter is to notify you that your financial test should be updated and sent to the Director of the Michigan Department of Natural Resources within 90 days after the close of your fiscal year.

If you have any questions or desire additional information, please contact Ms. Sharon Johnson at (312) 886-4581 or Ronald Brown at (312) 353-7921.

Sincerely yours,

Wm. E. Muno

William E. Muno, Chief
RCRA Enforcement Section

cc: John Bohunsky, MDNR

MID 021 906 804

DETREX CHEMICAL INDUSTRIES, INC.

P.O. BOX 501, DETROIT, MICHIGAN 48232

EXECUTIVE OFFICE

TELEPHONE (313) 358-5800

TWX 810-224-4756

March 31, 1986

Regional Administrator
EPA Region V
P. O. Box 7861
Chicago, IL 60680

RE: Financial Requirements - Annual Report

Dear Sir:

Enclosed is the following:

1.) A letter by our chief financial officer

2.) Our 1985 Annual Report

3.) A statement by our independent Certified Public Accountant

Should you have any questions, please call me.

Very truly yours,

W. G. Robrecht
Manager of Corporate Engineering

WGR:bb
encl.

2471

DETREX
CORPORATION

1988 ANNUAL REPORT

HIGHLIGHTS

	1988	1987	1986
Net sales	$105,004,000	$100,257,000	$94,205,000
Income before accounting change	3,233,000	2,639,000	2,495,000
Cumulative effect of accounting change		458,000	
Net income	3,233,000	3,097,000	2,495,000
Earnings per common share before accounting change	2.05	1.67	1.58
Cumulative effect of accounting change per common share		.29	
Earnings per common share	2.05	1.96	1.58
Cash dividends per common share	1.20	1.20	1.20
Stockholders' equity per common share	26.81	25.96	25.20
Additions to land, buildings and equipment	3,142,000	3,921,000	6,902,000
Current ratio	3.2 to 1	3.5 to 1	3.7 to 1
Percent long-term debt to equity	15.2	17.9	20.8
Number of stockholders	742	762	825
Number of employees	659	595	742

TO OUR SHAREHOLDERS:

Detrex sales and net income were $105,004,000 and $3,233,000, respectively, for 1988 compared with $100,257,000 and $3,097,000, respectively, for 1987. Net income for 1987 includes $458,000 for the effect of an accounting change concerning deferred income taxes.

Research and development expenditures during 1988 were $2,620,000, an increase of approximately 13% over the prior year. These expenditures, which represented 2.5% of our sales dollars in 1988, and 2.3% in 1987, are expected to result in expanded sales and earnings for Detrex in the future.

As a result of our research and development activities, a number of new products have been introduced, including: new generation single component conductive primer coatings for use over plastic substrates; combination primer-topcoat urethane coating compositions; a complete package grease additive for use primarily with lithium based greases; a self contained package product for slideway lubrication; a new line of cooling water treatment products which are completely organic and free of heavy metals; new coatings for the fastener industries which provide significantly extended corrosion protection; and new pre-paint phosphate coating systems which provide superior paint adhesion and corrosion resistance on steel surfaces, as well as on zinc and zinc-rich substrates.

A significant organizational change was made during the year. C. B. Stockmeyer, Jr. and T. A. McGregor were elected Group Vice Presidents and assigned additional profit center responsibilities. These new assignments will help coordinate and facilitate our program of providing our customers with a single source for the different products they use to clean, coat and test the various metal and plastic products they manufacture in their plants.

As a single source supplier, Detrex can provide overall single company responsibility, competent professional services, including analytical and testing laboratory services, and a broad array of product lines which are required by industrial plants. These product lines include: coolants; drawing compounds and other metalworking compounds; aqueous and solvent cleaners; pre-paint phosphate and other chemical conversion coatings; primers, paints and specialty coatings; paint booth compounds and coatings; and products for water treatment of boilers, cooling towers and plant effluent. We expect that this "total package" approach will lead to important new business volume for our company.

Our new ventures program is ongoing and we are continuing to review various opportunities which are an appropriate "fit" for Detrex and which aid us in our diversification objectives.

Our employees have provided excellent cooperation and fine performance for which we extend our sincere appreciation.

Louis Schlossberg
President

A. O. Thalacker
Chairman

ˑ ˑREX CORPORATION

◡ONSOLIDATED BALANCE SHEETS

December 31

ASSETS

	1988	1987
Current Assets:		
Cash and cash equivalents	$ 531,982	$ 4,621,438
Certificates of deposit	3,000,000	
Accounts receivable	19,567,076	17,062,604
Inventories	15,365,290	13,860,121
Prepaid expenses and other	803,684	822,629
Total Current Assets	39,268,032	36,366,792
Land, Buildings and Equipment:		
Land	1,044,468	1,044,468
Buildings and improvements	16,203,299	15,985,142
ᐠinery and equipment	26,397,765	24,443,866
.ruction in progress	722,552	1,057,105
	44,368,084	42,530,581
Less allowance for depreciation and amortization	22,407,205	20,210,281
Land, Buildings and Equipment—Net	21,960,879	22,320,300
Other Assets	1,911,598	2,040,581
	$63,140,509	$60,727,673

.otes to Consolidated Financial Statements.

LIABILITIES AND STOCKHOLDERS' EQUITY

	1988	1987
Current Liabilities:		
Current maturities of long-term debt	$ 1,543,673	$ 1,568,354
Accounts payable	5,490,553	4,312,881
Income taxes	265,694	198,767
Accrued payroll, commissions and pension	1,681,171	1,294,330
Accrued insurance and other	3,267,367	3,030,150
Total Current Liabilities	12,248,458	10,404,482
Long-Term Debt	6,422,786	7,343,734
Deferred Income Taxes	2,105,095	1,952,282
Stockholders' Equity:		
Common capital stock, $2 par value, authorized 4,000,000 shares, outstanding 1,580,414 shares	3,160,828	3,160,828
Retained earnings	39,203,342	37,866,347
Total Stockholders' Equity	42,364,170	41,027,175
	$63,140,509	$60,727,673

See Notes to Consolidated Financial Statements.

TREX CORPORATION

CONSOLIDATED STATEMENTS OF INCOME AND RETAINED EARNINGS

For the Years Ended December 31

	1988	1987	1986
Net Sales	$105,003,570	$100,256,924	$94,204,793
Costs and Expenses:			
Cost of sales	75,868,557	72,781,067	68,254,108
Selling, general and administrative expenses	20,174,727	19,201,960	18,382,335
Provision for depreciation and amortization	3,125,796	2,981,320	2,689,341
Total Costs and Expenses	99,169,080	94,964,347	89,325,784
Operating income	5,834,490	5,292,577	4,879,009
Other income—net	322,712	489,068	284,950
Interest expense	789,989	943,394	425,213
Income before income taxes	5,367,213	4,838,251	4,738,746
Provision for income taxes	2,133,721	2,199,382	2,243,702
~me before accounting change	3,233,492	2,638,869	2,495,044
~ulative effect on prior years of change in accounting for income taxes		457,704	
Net Income	3,233,492	3,096,573	2,495,044
Retained Earnings at Beginning of Year	37,866,347	36,666,271	36,067,724
	41,099,839	39,762,844	38,562,768
Deduct:			
Cash dividends on common stock—1988, 1987 and 1986, $1.20 per share	1,896,497	1,896,497	1,896,497
Retained Earnings at End of Year	$ 39,203,342	$ 37,866,347	$36,666,271
Earnings Per Common Share:			
Before accounting change	$2.05	$1.67	$1.58
Cumulative effect of accounting change		.29	
Net Earnings	$2.05	$1.96	$1.58

~ Notes to Consolidated Financial Statements.

DETREX CORPORATION

CONSOLIDATED STATEMENT OF CASH FLOWS

For the Year Ended December 31, 1988

Cash Flows from Operating Activities:	
Net income	$3,233,492
Adjustments to reconcile net income to net cash provided by operating activities:	
Depreciation and amortization	3,125,796
Gain on disposals of machinery and equipment	(12,727)
Increase in accounts receivable	(2,504,472)
Increase in inventories	(1,565,291)
Decrease in prepaid expenses and other	18,945
Increase in other assets	(64,102)
Increase in accounts payable	1,177,672
Increase in income taxes	66,927
Increase in accrued payroll, commissions and pension	386,841
Increase in accrued insurance and other	237,217
Increase in noncurrent deferred income taxes	152,813
Total adjustments	1,019,619
Net cash provided by operating activities	4,253,111
sh Flows from Investing Activities:	
Purchase of certificates of deposit	(4,012,600)
Redemption of certificate of deposit	1,012,600
Proceeds from disposals of machinery and equipment	641,616
Capital expenditures	(2,328,024)
Net cash used in investing activities	(4,686,408)
Cash Flows from Financing Activities:	
Repayment of long-term debt	(1,043,854)
Principal payments under capital lease obligations	(715,808)
Cash dividends	(1,896,497)
Net cash used in financing activities	(3,656,159)
Net decrease in cash and cash equivalents	(4,089,456)
Cash and cash equivalents at beginning of year	4,621,438
Cash and cash equivalents at end of year	$ 531,982

Supplemental Disclosures of Cash Flow Information:

Cash paid during the year for:	
Interest	$ 803,702
Income taxes	1,996,259

Supplemental Schedule of Noncash Investing and Financing Activities:

Capital lease obligations of $814,033 were incurred when the Company entered into new leases for transportation equipment.

See Notes to Consolidated Financial Statements.

D REX CORPORATION

CONSOLIDATED STATEMENTS OF CHANGES IN FINANCIAL POSITION

For the Years Ended December 31

	1987	1986
Funds Provided:		
Operations:		
Income before accounting change	$ 2,638,869	$ 2,495,044
Add (deduct) items not affecting funds:		
Depreciation and amortization	2,981,320	2,689,341
Deferred income taxes	(805,701)	684,867
Total from Operations Before Accounting Change	4,814,488	5,869,252
Cumulative effect of accounting change	457,704	
Total from Operations	5,272,192	5,869,252
Working Capital Changes:		
Accounts receivable	2,015,471	(2,600,210)
Inventories	592,290	(1,487,759)
Prepaid expenses and other	446,355	(146,566)
Current maturities of long-term debt	843,545	187,098
Accounts payable	(56,211)	812,668
Income taxes	142,164	(43,170)
Accrued payroll, commissions and pension	(563,789)	68,602
Accrued insurance and other	59,207	(101,914)
Total from Working Capital Changes	3,479,032	(3,311,251)
Disposals of machinery and equipment	385,608	417,932
Increase in long-term debt		7,685,888
Total Funds Provided	9,136,832	10,661,821
Funds Used:		
Expenditures for buildings and equipment	3,920,592	6,901,854
Cash dividends	1,896,497	1,896,497
Increase in other assets	142,342	1,129,157
Decrease in long-term debt	944,487	
Total Funds Used	6,903,918	9,927,508
Increase in Cash and Cash Equivalents	$ 2,232,914	$ 734,313

Notes to Consolidated Financial Statements.

DETREX CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Summary of Significant Accounting Policies

Basis of Financial Statements

The consolidated financial statements comprise those of the Company and all of its subsidiaries. All balances and transactions between the companies have been eliminated. Certain amounts for years prior to 1988 have been reclassified for comparative purposes.

Inventories

Inventories are stated at the lower of cost or market. Cost of raw materials, including raw materials in work in process and finished goods inventories, is determined by using the last-in, first-out method. Labor and burden in inventory are determined by using the average cost method. Inventories relating to fixed-price contracts are stated at the accumulated cost of material, labor and burden less related progress billings.

Land, Buildings and Equipment

Land, buildings and equipment are stated at cost. Depreciation and amortization are provided over the estimated useful lives of the assets using the straight-line method r financial reporting purposes. Leased equipment is amortized over the lease term. Annual depreciation rates for financial reporting purposes range from 2.5% to 20% for buildings and improvements and from 6.7% to 33.3% for machinery and equipment.

Research and Development

Research and development costs are charged to income as incurred. Research and development costs for 1988, 1987 and 1986 were approximately $2,620,000, $2,326,000 and $2,629,000, respectively.

Earnings Per Common Share

Earnings per common share are based upon the average number of common shares outstanding during the year.

Industry Segment

The Company and its subsidiaries operate predominantly in a single industry, chemicals and allied products, and supply processes for use by manufacturing and service industries.

Cash Flows

During 1988, the Company adopted Statement of Financial Accounting Standards No. 95, "Statement of Cash Flows." For purposes of the consolidated statement of cash flows, cash equivalents are defined as short-term highly-liquid investments with original maturities of three months less.

2. Inventories

Inventories at December 31 consist of the following:

	1988	1987
Raw materials	$ 5,873,878	$ 5,112,582
Work in process	2,089,368	1,581,974
Finished goods	7,402,044	7,165,565
Total	$15,365,290	$13,860,121

The excess of current cost over the stated last-in, first-out value is approximately $1,908,000 and $1,666,000 at December 31, 1988 and 1987, respectively.

3. Capital and Operating Leases

Capitalized leased assets (primarily automobiles, railroad tank cars and trucks and trailers) at December 31 are as follows:

	1988	1987
Machinery and equipment	$2,219,164	$2,139,972
Accumulated amortization	1,137,773	1,165,264
Leased assets—net	$1,081,391	$ 974,708

Rent expense applicable to operating leases for 1988, 1987 and 1986 was $663,000, $710,000 and $597,000, respectively.

Minimum annual lease payments for leases in effect at December 31, 1988 are as follows:

Minimum Lease Payments:	Capital	Operating
1989	$ 656,600	$ 490,000
1990	524,100	126,000
1991	252,500	15,000
1992	60,300	15,000
1993		15,000
Total minimum lease payments	1,493,500	$ 661,000
Less amount representing estimated executory costs (such as taxes, maintenance and insurance) and profit thereon included in total minimum lease payments	127,124	
Net minimum lease payments	1,366,376	
Less amount representing interest	263,522	
Present value of net minimum lease payments	1,102,854	
Less current portion	467,063	
Non-current portion	$ 635,791	

4. Long-Term Debt

The composition of long-term debt, exclusive of current maturities, as of December 31 is as follows:

	1988	1987
Term note at interest rate of 8.9%; due through 1991	$5,750,000	$6,750,000
Mortgages payable with interest principally at .9%; due through 1994	36,995	48,113
Capitalized lease obligations at interest rates from 5.7% to 15.1%; due through 1990 (see Note 3)	635,791	545,621
	$6,422,786	$7,343,734

The approximate aggregate annual maturities of long-term debt (exclusive of capital lease obligations) for the five years subsequent to December 31, 1988 are as follows: 1989, $1,076,610; 1990, $1,011,462; 1991, $4,757,987; 1992, [illegible]; 1993 and after, $9,489.

The Company had unused lines of credit of $6,000,000 as of December 31, 1988.

5. Income Taxes

The Company adopted Statement of Financial Accounting Standards No. 96, "Accounting for Income Taxes," effective January 1, 1987. The cumulative effect of the change on prior years was to increase income in 1987 by $457,704 or $.29 per share. Deferred income taxes for 1986 were computed based on generally accepted accounting principles in effect for that period.

The provision for income taxes for the years ended December 31 is summarized below:

	1988	1987	1986
Current:			
Federal	$1,748,861	$1,605,511	$1,387,521
State and local	299,697	270,983	211,030
Total current	2,048,558	1,876,494	1,598,551
Deferred:			
Federal	101,245	257,783	539,089
State and local	(16,082)	65,105	106,062
Total deferred	85,163	322,888	645,151
	$2,133,721	$2,199,382	$2,243,702

Deferred taxes result from timing differences in the recognition of revenue and expense for tax and financial statement purposes. The sources of these differences and the tax effect of each were as follows:

	1988	1987	1986
Depreciation and amortization	$ 239,741	$ 207,263	$ 388,625
Pension	(149,149)	34,485	(21,712)
Undistributed earnings of Company's DISC	33,810	79,949	210,524
Other—net	(39,239)	1,191	67,714
	$ 85,163	$ 322,888	$ 645,151

The effective income tax rates for 1988, 1987 and 1986 were 39.8%, 45.5% and 47.4%, respectively. The reasons for the difference between the income tax provision which resulted in these effective rates and income taxes computed at 34% for 1988, 40% for 1987 and 46% for 1986 are summarized below:

	1988	1987	1986
Computed "expected" tax provision	$1,824,852	$1,935,300	$2,179,823
Research and development tax credit			(140,997)
State and local income taxes, net of federal tax benefit	187,185	201,653	171,230
Nondeductible meal and entertainment expense	33,556	41,918	
Other—net	88,128	20,511	33,646
	$2,133,721	$2,199,382	$2,243,702

6. Pension and Postretirement Costs

The Company and its subsidiaries have several noncontributory, defined benefit pension plans which cover substantially all employees. Benefits for salaried employees are based on years of service and the employee's average monthly compensation using the highest five consecutive years preceding retirement. Benefits for hourly employees are based on a specified payment per month for each year of service. The Company's funding policy is to contribute amounts sufficient to provide for benefits earned to date and those expected to be earned in the future.

The following table sets forth the plans' funded status and amounts recognized in the Company's balance sheet at December 31, 1988 and 1987:

	1988	1987
Actuarial present value of benefit obligations:		
Accumulated benefit obligations:		
Vested benefits	$12,810,482	$10,881,742
Non-vested benefits	979,587	1,185,444
Total	$13,790,069	$12,067,186
Projected benefit obligation for service rendered to date	$18,803,556	$16,950,314
Plan assets at fair value—primarily equity and fixed income bond funds and group annuity insurance contracts	20,427,603	19,306,313
Excess of plan assets over projected benefit obligation	1,624,047	2,355,999
Unrecognized net asset at January 1, 1986 being recognized principally over 15 years	(2,684,862)	(2,892,725)
Unrecognized net loss from past experience different from that assumed	677,116	488,604
Pension liability included in accrued payroll, commissions and pension	$ (383,699)	$ (48,122)

Net pension cost included the following components:

	1988	1987	1986
Service cost-benefits earned during the year	$ 768,591	$ 697,134	$ 608,841
Interest cost on projected benefit obligations	1,453,365	1,234,402	1,083,409
Actual return on plan assets	(1,759,390)	(1,110,709)	(2,290,313)
Net amortization and deferral	(27,988)	(814,895)	702,016
Net periodic pension cost	$ 434,578	$ 5,932	$ 103,953

The discount rate and rate of increase in future compensation levels used in determining the actuarial present value of the projected benefit obligation were 8.5% and 6.5%, respectively. The expected long-term rate of return on assets was 8.5%.

In addition to providing pension benefits, the Company and its subsidiaries provide certain health care benefits to retired employees. Some of the Company's employees may become eligible for the benefits if they reach normal retirement age while working for the Company. The cost of retiree health care benefits, which is immaterial, is recognized as an expense when the related premiums are paid.

7. Preferred Stock

The Company has authorized 1,000,000 shares of $2 par value preferred stock, issuable in series. No shares were issued or outstanding as of December 31, 1988, 1987 and 1986.

8. Other Income—Net

Other income consists principally of interest income of approximately $285,000, $238,000 and $69,000 for 1988, 1987 and 1986, respectively, and miscellaneous service income of $210,000, $340,000 and $386,000 in 1988, 1987 and 1986, respectively.

9. Contingencies

The U.S. Environmental Protection Agency ("EPA") has notified the Company and 17 other companies that they may be potentially responsible for sharing the costs involved in a proceeding to clean up contaminated sediments in the Fields Brook watershed in Ashtabula, Ohio. The EPA has issued a Record of Decision concerning the methods it recommends using to accomplish this task at an estimated total cost of $48,000,000. The Company and the other potentially responsible parties have expressed their disagreement with this recommendation, but will continue to negotiate with the EPA as to how best to effect the clean-up operation. At this time, management cannot determine when, and to what extent, the Company may have to share the costs associated with the clean-up. In addition, there are several other claims and lawsuits pending against the Company and its subsidiaries.

Although the amount of liability, if any, at December 31, 1988, with respect to the actions then pending to which the Company and its subsidiaries are party cannot be ascertained, the disposition of the above matters, in the opinion of management, on the basis of information furnished by counsel, will not have a material effect on the Company's consolidated financial position.

INDEPENDENT AUDITORS' REPORT

Deloitte Haskins+Sells
Certified Public Accountants

100 Renaissance Center
Detroit, Michigan 48243

To the Board of Directors and Stockholders of
Detrex Corporation

We have audited the accompanying consolidated balance sheets of Detrex Corporation and its subsidiaries as of December 31, 1988 and 1987 and the related consolidated statements of income and retained earnings for each of the three years in the period ended December 31, 1988, of cash flows for the year ended December 31, 1988 and of changes in financial position for each of the two years in the period ended December 31, 1987. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, such consolidated financial statements present fairly, in all material respects, the financial position of the companies at December 31, 1988 and 1987 and the results of their operations for each of the three years in the period ended December 31, 1988, their cash flows for the year ended December 31, 1988 and the changes in their financial position for each of the two years in the period ended December 31, 1987 in conformity with generally accepted accounting principles.

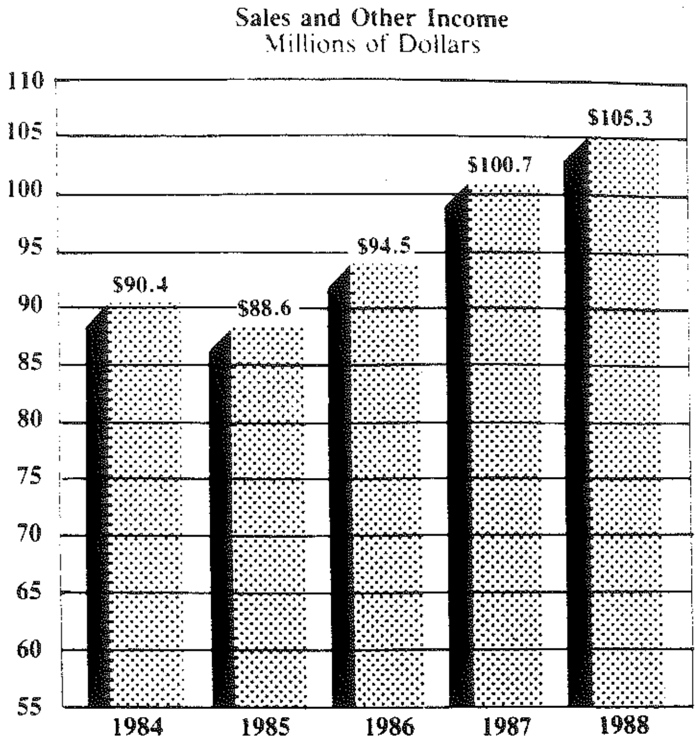
As discussed in Note 1 to the financial statements, the companies adopted the statement of cash flows in 1988 and as discussed in Note 5 changed their method of accounting for income taxes in 1987.

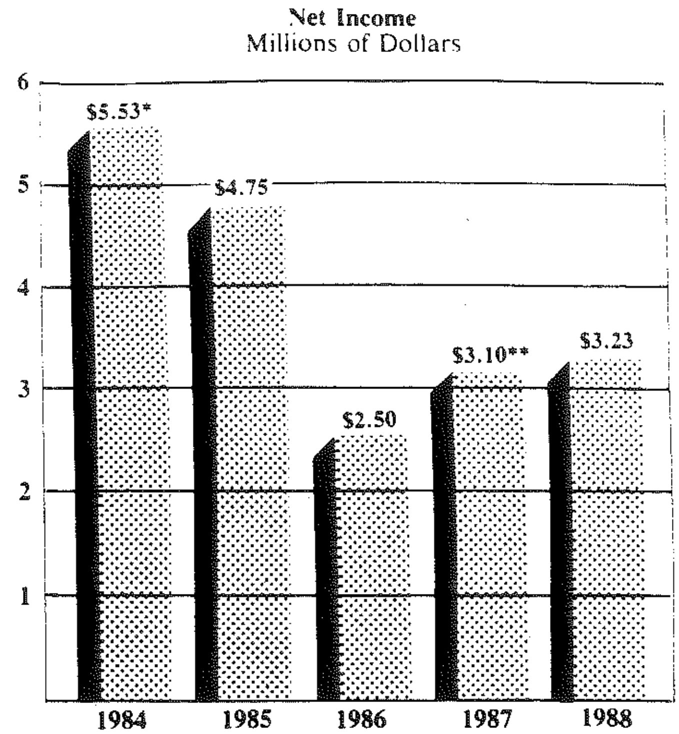
Deloitte Haskins + Sells

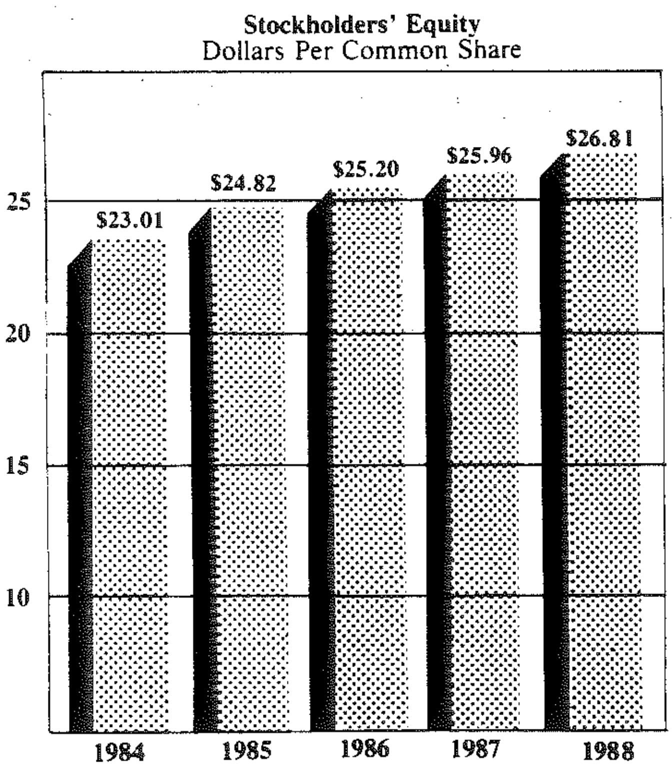
February 28, 1989

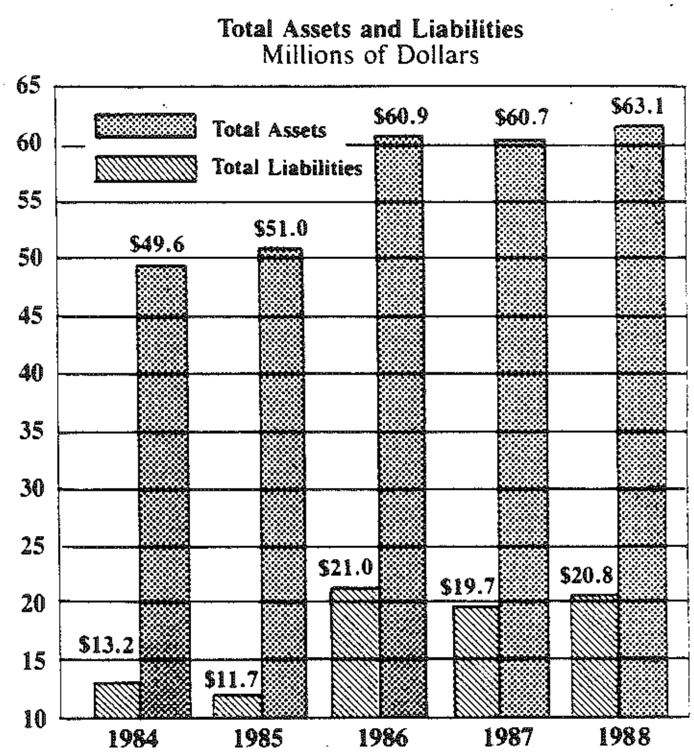
DETREX CORPORATION AND SUBSIDIARIES

5 YEAR HIGHLIGHTS









*Net income for 1984 reflects a deferred income tax reversal of $510,440 or $.32 per share due to a change in the tax law covering Domestic International Sales Corporations.

**Net income for 1987 reflects an income tax credit of $457,704 or $.29 per share which is the cumulative effect on prior years of an accounting change to adopt Statement of Financial Accounting Standards No. 96, "Accounting for Income Taxes."

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Liquidity and Capital Resources

The Company generates cash from operations sufficient to meet its normal needs for working capital, dividend payments on capital stock and capital expenditures, except for transportation equipment which is financed through leasing arrangements and the August 1986 purchase of Seibert-Oxidermo which was financed through long-term borrowings.

The Company does not presently plan to borrow additional long-term funds, sell securities or enter into any material off-balance sheet financing arrangements. The Company had unused lines of credit of $6,000,000 at December 31, 1988.

Selected Financial Information

Comparative operating data (in thousands) are summarized below:

	1988		1987		1986	
	$	%	$	%	$	%
Sales	105,004	100.0	100,257	100.0	94,205	100.0
Gross profit	29,135	27.7	27,476	27.4	25,951	27.6
Operating expenses	20,175	19.2	19,202	19.2	18,382	19.5
Depreciation and amortization	3,126	3.0	2,981	3.0	2,689	2.8
Operating income	5,835	5.6	5,293	5.3	4,879	5.2
Net income	3,233	3.1	3,097	3.1	2,495	2.7

The year 1988—Sales increased approximately $4,700,000 over 1987 resulting from increases in chemical products a[illegible]emical equipment sales of approximately $3,800,000 and $900,000, respectively. Gross profit as a percentage of [illegible]emained relatively constant with the prior year.

Operating expense increases of approximately 5.0% over 1987 reflect modest inflationary pressures on employee salary and related costs, as well as increases in pension and research and development expenses of approximately $429,000 and $294,000, respectively. The operating expenses as a percentage of sales were comparable to the prior year.

Increases in sales and continuing attention to cost controls enabled the Company to attain a 10.2% increase in operating income over the year 1987.

The reduction in the income tax rate in 1988 had the effect of increasing net income by approximately $306,000 compared to 1987.

The year 1987—Sales of chemical products increased approximately $9,800,000 over 1986 resulting primarily from including the operations of Seibert-Oxidermo for a full year compared to a portion of the year in 1986. Sales of chemical equipment decreased by approximately $3,700,000 compared to 1986.

The relatively level percentage of gross profit to sales as compared with the year 1986 was the net result of continuing price competition (primarily in chemical products) which decreased 1987 gross profit by 1.7%, offset by the absence of any special charges as were experienced in the fourth quarter of 1986 which had the effect of increasing 1987 gross profit by 1.5%.

Operating expenses as a percentage of sales showed an improvement of .3% over 1986 primarily resulting from a streamlining of operations and a slight decrease in research and development spending.

Interest expense increased by approximately $518,000 over 1986 due primarily to the debt incurred in 1986 in connection with the purchase of Seibert-Oxidermo.

The adoption of Statement of Financial Accounting Standards No. 96, "Accounting for Income Taxes" resulted in a credit to net income of approximately $458,000 or $.29 per common share.

The year 1986—Sales of chemical products increased by approximately $4,400,000 over 1985 resulting primarily from the [illegible]gust 1986 acquisition of Seibert-Oxidermo. Sales of chemical equipment increased by approximately $1,500,000 [illegible]pared to 1985. The increase in gross profit from the greater sales volume was more than offset by a fourth quarter

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS—Continued

charge of approximately $1,500,000 for cost overruns relating to new products developed, product warranties and related liabilities, and from decreasing margins due to price competition.

The gross profit percentage decreased from 31.2% in 1985 to 27.6% in 1986. The primary factors causing this decrease were the fourth quarter charge of 1.6% and increased price competition in the chemical products of approximately 2.0%.

Operating expense increases of $1,900,000 over 1985 reflect higher research and development costs of $2,629,000 for 1986 compared to $1,642,000 for 1985, the inclusion of Seibert-Oxidermo starting in August 1986 and modest inflationary pressures.

Interest expense increased by $300,000 over 1985 due primarily to the debt incurred in connection with the purchase of Seibert-Oxidermo in August 1986.

Inflation—The moderate levels of inflation during the three year period have not had any significant impact on the Company.

Plant Utilization Levels—The Company's plant utilization levels have not changed significantly and had no material effect on the results of operations for the years 1988, 1987, and 1986.

Other

The year 1988—The adoption of Statement of Financial Accounting Standards No. 95, "Consolidated Statement of Cash Flows" had no effect on the Company's financial condition or results of operations. The Company knows of no unadopted accounting pronouncements that will have a material impact on its financial condition and results of operations.

The year 1986—The Company adopted Statement of Financial Accounting Standards No. 87, "Employer's Accounting for Pensions" in 1986. The effect of adopting Statement 87 was not material to the 1986 financial statements.

DESCRIPTION OF BUSINESS

Detrex Corporation and its subsidiaries operate predominantly in a single industry, chemicals and allied products, and supply processes for use by manufacturing and service industries. The principal products include specialty chemicals, industrial cleaners, phosphate coatings, drawing lubricants, chlorinated solvents, reagent grade muriatic acid, PVC plastic products, industrial finishing materials and paints, water treatment chemicals, and chemical equipment, including degreasing equipment, drycleaning machines, and industrial furnaces. The products are primarily sold by sales-service engineers. Most sales are direct to industrial users with lesser amounts to distributors for resale to industrial users.

Net sales by product line for each of the last five years are set forth below:

	Net Sales		
	Product Line		
	Chemical Products	Chemical Equipment	Total
1988	$80,323,544	$24,680,026	$105,003,570
1987	76,512,225	23,744,699	100,256,924
1986	66,725,717	27,479,076	94,204,793
1985	62,337,906	25,930,359	88,268,265
1984	70,375,994	19,578,927	89,954,921

A COPY OF THE COMPANY'S ANNUAL REPORT ON FORM 10-K AS FILED WITH THE SECURITIES AND EXCHANGE COMMISSION FOR THE YEAR 1988 WILL BE FURNISHED WITHOUT CHARGE TO SHAREHOLDERS UPON WRITTEN REQUEST. REQUESTS ARE TO BE SENT TO VICE PRESIDENT-TREASURER, DETREX CORPORATION, 4000 TOWN CENTER, SUITE 1100, SOUTHFIELD, MICHIGAN 48075.

' PPLEMENTARY INFORMATION

,elected Quarterly Data (Thousands of dollars except per share amounts)

	1988 Quarters				1987 Quarters			
	4th	3rd	2nd	1st	4th	3rd	2nd	1st
Net sales	$25,388	$26,441	$27,620	$25,555	$24,040	$26,479	$25,010	$24,728
Gross profit on sales	6,425	7,405	7,919	7,386	5,890	6,966	7,559	7,061
Income before accounting change	193	774	1,208	1,058	85	579	1,077	898(1)
Cumulative effect of accounting change								458(1)
Net income	193	774	1,208	1,058	85	579	1,077	1,356(1)
Earnings per common share before accounting change	.13	.49	.76	.67	.05	.36	.70	.56(1)
Cumulative effect of accounting change per common share								.29(1)
Earnings per common share	.13	.49	.76	.67	.05	.36	.70	.85(1)
Dividends per common share	.30	.30	.30	.30	.30	.30	.30	.30
Stock price range(3)								
High	31¼	33½	33½	25½	32	37¼	40½	44
Low	27⅛	28	24½	20	20	30	35¼	37½

Notes for Selected Quarterly Data and Selected Financial Data

(1) Previously reported earnings for the 1987 first quarter have been restated to include a credit of $457,704, or $.29 per common share, which is the cumulative effect on prior years of an accounting change to adopt Statement of Financial Accounting Standards No. 96, "Accounting for Income Taxes." The effect of the change on the first three quarters of 1987 was not material.

(2) Net income as a percent of sales and other net income ratios for 1984 reflect a deferre ome tax reversal of $510,440 or $.32 per share due to a change in the tax law covering Domestic International Sales Corporations.

,, Stock price range was obtained from National Over-The-Counter bid prices.

Selected Financial Data

(Thousands of dollars except per share amounts)

	1988	1987	1986	1985	1984
Net sales	$105,004	$100,257	$94,205	$88,268	$89,955
Income before accounting change	3,233	2,639(1)	2,495	4,753	5,531(2)
Cumulative effect of accounting change		458(1)			
Net income	3,233	3,097(1)	2,495	4,753	5,531(2)
Earnings per common share before accounting change	2.05	1.67(1)	1.58	3.01	3.50(2)
Cumulative effect of accounting change per common share		.29(1)			
Earnings per common share	2.05	1.96(1)	1.58	3.01	3.50(2)
Dividends per common share	1.20	1.20	1.20	1.20	1.20
Total assets	63,141	60,728	60,853	50,960	49,613
Net working capital	27,020	25,962	27,208	23,163	22,74[illegible]
Additions to land, buildings and equipment	3,142	3,921	6,902	4,614	4,259
Long-term debt	6,423	7,344	8,288	602	753
Stockholders' equity	42,364	41,027	39,827	39,229	36,372
Stockholders' equity per common share	26.81	25.96	25.20	24.82	23.01
Number of employees	659	595	742	666	617
Percentages to net sales:					
Gross profit	27.7	27.4	27.6	31.2	30.2
Net income	3.1	3.1(1)	2.7	5.4	6.1(2)
Net income as a percent of:					
Average total assets	5.2	5.1(1)	4.5	9.5	11.6(2)
First of year stockholders' equity	7.9	7.8(1)	6.4	13.1	16.9(2)
Current ratio	3.2	3.5	3.7	3.6	3.1
Percent long-term debt to equity	15.2	17.9	20.8	1.5	2.1

PRODUCTS OF DETREX AND DETREX SUBSIDIARIES

INDUSTRIAL CHEMICAL SPECIALTIES DIVISION
26000 CAPITOL AVENUE
REDFORD, MICHIGAN 48239-2499
T. A. McGREGOR, Vice President and General Manager

Immersion Phosphate Coatings—"Perm-Cote"
Industrial Cleaners
Rolling Oils
Spray Phosphate Coatings—"Paintbond"
Metalworking Compounds
Corrosion Preventives
Ultrasonic Phosphate—Hydrasonic
Ultrasonic Conversion Coatings

SOLVENTS DIVISION
P. O. BOX 1398,
ASHTABULA, OHIO 44004
R. J. JONES, Vice President and General Manager

Trichloroethylene—"Perm-A-Clor NA"
Perchloroethylene
1,1,1-Trichloroethane—"Perm-Ethane"
Trichlorotrifluoroethane (Freon TF)
Solvent Reclamation and Waste Management

EQUIPMENT DIVISION
P. O. BOX 5111,
SOUTHFIELD, MICHIGAN 48086-5111
C. B. STOCKMEYER, JR., Vice President and General Manager

Degreasing Equipment
Industrial Ultrasonic Machines
Environmental Emission Control Devices
Electronic Component Cleaning and Defluxing Machines
Soldering Machines
Hospital Ultrasonic Machines
Drycleaning Machines

CHEMICALS DIVISION
P. O. BOX 1398,
[illegible]HTABULA, OHIO 44004
[illegible]. JONES, Vice President and General Manager

Muriatic Acid
N-Methyl Pyrrole
Pyrrole
Reagent Chemicals—Muriatic Acid, Sulfuric Acid
Nitric Acid

PACIFIC INDUSTRIAL FURNACE DIVISION
P. O. BOX 5111,
SOUTHFIELD, MICHIGAN 48086-5111
R. E. THALACKER, General Manager

Industrial Furnaces for:
Metal Treating
Sintering
Annealing
Hardening
Forging

THE ELCO CORPORATION
P. O. BOX 09168,
CLEVELAND, OHIO 44109
DR. W. T. BRANNEN, Executive Vice President

Chemical Additives for Gear Lubricants, Transmission, Hydraulic and Motor O[illegible]
Industrial Gear Lubrican[illegible]

HARVEL PLASTICS, INC.
P. O. BOX 757,
EASTON, PENNSYLVANIA 18042
H. G. WISMER, President

Rigid PVC Plastic Pipe
(Normal Impact)
(High Impact)
Solid Bar, Heavy Wall Tubular Stock, Angle Stock, Custom Extrusions

VIKING CHEMICALS, INC.
8 BRUSH STREET,
PONTIAC, MICHIGAN 48053
D. P. ANDERSON, Executive Vice President

Water Treatment Chemicals and Equipment

SEIBERT-OXIDERMO, INC.
16255 WAHRMAN
ROMULUS, MICHIGAN 48174
T. A. McGREGOR, Vice President and General Manager
Industrial Finishing Materials
Automotive Paints

WAYNE CHEMICAL PRODUCTS COMPANY
9470 COPLAND,
DETROIT, MICHIGAN 48209-2680
L. P. GOWMAN, Executive Vice President

Cutting Fluids
Industrial Cleaners
Drawing Lubricants
Rust Preventives
Fluxes and Solders
Chemical Sealants
Soluble Oils

DIRECTORS

H. GLENN BIXBY
Former Chairman,
Ex-Cell-O Corporation

CHARLES B. BREEDLOVE
Former Executive Vice President and Director of Reichhold Chemicals, Inc.

BRUCE W. COX
President, B. W. Cox Company, Manufacturers Representative

ROBERT A. EMMETT, III
Partner, Reed Smith Shaw & McClay, Attorneys, Washington, D.C.

T. KENNETH HAVEN
Director

LOUIS SCHLOSSBERG
President

ARBIE O. THALACKER
Chairman of the Board

ARBIE R. THALACKER
Partner, Shearman & Sterling, Attorneys, New York City

AUDIT COMMITTEE

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CHARLES B. BREEDLOVE
T. KENNETH HAVEN

TRANSFER AGENT AND REGISTRAR

NATIONAL BANK OF DETROIT

AUDITORS

DELOITTE HASKINS & SELLS

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Vice President

T. A. McGREGOR
Group Vice President

C. B. STOCKMEYER, JR.
Group Vice President and Treasurer

F. J. CHMIELNICKI
Secretary

F. X. GALLANT
Controller and Assistant Secretary

E. R. RONDEAU
Assistant Controller